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RESEARCH MEMORANDUM

FLIGHT-DETERMINED PRESSURE DISTRIBUTIONS OVER A
SECTION OF THE 35° SWEPT WING OF THE DOUGLAS D-558-II
RESEARCH AIRPLANE AT MACH NUMBERS UP TO 2.0

By Gareth H. Jordan and Earl R. Keener

High-Speed Flight Station
Edwards, Calif.

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RESEARCH MEMORANDUM

FLIGHT-DETERMINED PRESSURE DISTRIBUTIONS OVER A
SECTION OF THE 35° SWEPT WING OF THE DOUGLAS D-558-II
RESEARCH AIRPLANE AT MACH NUMBERS UP TO 2.0

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SUMMARY

Measurements of pressure distributions have been made over a wing midsemispan station on the 35° sweptback wing of the Douglas D-558-II research airplane at Mach numbers from 1.17 to 2.0.

The results of the investigation indicate that, as the angle of attack increased at the higher Mach numbers, the pressure coefficient for a vacuum limited the extent to which the upper-surface pressures could expand. Consequently most of the increase in section normal-force coefficient at high angles of attack can be attributed to the increase in pressure over the lower surface.

At high subsonic speeds the center of pressure rapidly moved rearward with increasing Mach number. At supersonic Mach numbers the center of pressure moved rearward both with increasing Mach number and with increasing angle of attack.

INTRODUCTION

Flight tests of the 35° sweptback wing of the Douglas D-558-II research airplane are being conducted by the NACA High-Speed Flight Station at Edwards, Calif. A pressure survey has previously been made of the wing surface to determine the chordwise and spanwise load distribution at subsonic and transonic Mach numbers. Some of these data have been reported in reference 1. Because of the interest in the wing section characteristics of subsonic-type airfoils at supersonic speeds, sufficient instrumentation was included in the airplane during recent exploratory flights at supersonic speeds to determine the chordwise pressure distribution of a midsemispan wing station perpendicular to the

30-percent-common-chord line. The data presented herein show the effect of Mach number and angle of attack in the Mach number range of 1.17 to 2.00.

SYMBOLS

| | |
|-----------|--|
| $b/2$ | wing semispan, 12.5 ft |
| C_{N_A} | airplane normal-force coefficient, nW/qS |
| c | local wing chord of midsemispan station perpendicular to 30-percent-common-chord line, 5.88 ft |
| $c_m c/4$ | section pitching-moment coefficient about 0.25c, $\int_0^1 \frac{p_L - p_U}{q} (0.25 - x/c) \cdot d\frac{x}{c}$ |
| c_n | section normal-force coefficient, $\int_0^1 \frac{p_L - p_U}{q} d\frac{x}{c}$ |
| c_{n_U} | contribution of upper surface to section normal-force coefficient, $\int_0^1 \frac{p_O - p_U}{q} d\frac{x}{c}$ |
| c_{n_L} | contribution of lower surface to section normal-force coefficient, $\int_0^1 \frac{p_L - p_O}{q} d\frac{x}{c}$ |
| g | acceleration due to gravity, ft/sec^2 |
| M | free-stream Mach number |
| n | normal load factor, g units |
| P | pressure coefficient, $\frac{p - p_O}{q}$ |

| | |
|-------------|---|
| P_{cr} | critical pressure coefficient (pressure coefficient at sonic velocity), $\frac{2}{\gamma M^2} \left[\left(\frac{2}{\gamma + 1} + \frac{\gamma - 1}{\gamma + 1} M^2 \right)^{\frac{\gamma}{\gamma - 1}} - 1 \right]$ |
| p | local static pressure, lb/sq ft |
| p_0 | free-stream static pressure, lb/sq ft |
| q | free-stream dynamic pressure, lb/sq ft |
| S | total wing area, including area projected through fuselage, 175 sq ft |
| W | airplane weight, lb |
| x | chordwise distance rearward of leading edge of local chord, ft |
| x_{cp} | chordwise center of pressure, $\left(0.25 - \frac{c_m c / 4}{c_n} \right) 100$, percent chord |
| α | airplane angle of attack, deg |
| γ | ratio of specific heats |
| Subscripts: | |
| L | lower surface |
| U | upper surface |

DESCRIPTION OF AIRPLANE AND ORIFICE STATION

The Douglas D-558-II research airplane used in these tests is shown in figure 1. A three-view drawing of the airplane showing the general overall dimensions is shown in figure 2. Physical characteristics of the airplane are given in table I.

The airplane was designed for Mach numbers above 1.0, and has a wing whose 30-percent-common-chord line is swept back 35° . The wing taper ratio and aspect ratio are 0.565 and 3.57, respectively.

The orifice station for which data are presented in this paper is a midsemispan station, normal to the 30-percent-common-chord line, as shown in figure 3. This midsemispan station intersects the 30-percent-common-chord line at $0.574b/2$ and extends over the leading-edge slat and trailing-edge flap. The root and tip wing sections, normal to the 30-percent-common-chord line, are NACA 63-010 and 63₁-012 airfoils, respectively. The wing section thickness is 10.86 percent of the chord at the orifice station, the ordinates of which are presented in table II. For these tests the leading-edge slat was locked in the closed position and the trailing-edge flap was undeflected.

INSTRUMENTATION

Standard NACA instruments pertaining to the pressure-distribution measurements were installed in the airplane to record indicated free-stream static and dynamic pressures, normal acceleration at airplane center of gravity, airplane angle of attack, and angle of sideslip. All instruments were synchronized by a common timer.

An NACA high-speed pitot-static tube was mounted on a boom which projected from the nose of the airplane. The angle-of-attack and angle-of-sideslip vanes were attached to the nose boom. The position error introduced by the pressure field in the vicinity of the tube was calibrated by comparing the static pressure measured from the airspeed head and the altitude of the airplane measured by radar with the pressure and altitude determined from a radiosonde balloon released at the time of flight.

Flush-type orifices installed in the wing skin were connected by 1/8-inch-inside-diameter tubing to NACA 24-cell recording manometers located in the instrument compartment. The length of tubing varied from 15 to 20 feet. One side of each manometer cell was connected to the orifice and the other side was vented to the instrument compartment. The instrument compartment pressure was recorded separately to establish a reference pressure for the manometers.

TESTS AND METHODS

Wing section pressure-distribution data were obtained during two dives to $M \approx 2.0$ at altitudes from 70,000 to 55,000 feet and from wind-up turns at Mach numbers between 1.17 and 1.85 at altitudes from 45,000 to 65,000 feet.

Mach number and free-stream static pressure were obtained from the measured free-stream static and impact pressures by using the airspeed calibration mentioned previously. The measured wing surface pressures were reduced to pressure coefficients. Chordwise distributions of these pressure coefficients were plotted for the test section and mechanically integrated to obtain normal-force coefficient and pitching-moment coefficient.

ACCURACY

The accuracy of the test results is estimated to be within the following limits:

RESULTS AND DISCUSSION

Pressure Distributions

The chordwise pressure coefficients obtained at supersonic Mach numbers over the wing midsemispan station are given in tabular form in tables III to IX. From these data representative pressure distributions were selected that illustrate the changes that occurred with Mach number and angle of attack. Figures 4 and 5 show the effect of Mach number at $c_n \approx 0.25$ and $c_n \approx 0.40$, respectively. Figures 6 to 10 show the effect of angle of attack on the chordwise pressure distribution at various Mach numbers from 1.17 to 2.00.

Effect of Mach number.— Pressure distributions at $c_n \approx 0.25$ are shown in figure 4 for Mach numbers from 0.65 to 2.00. The pressure distributions at $M = 0.65, 0.85$, and 0.90 are from reference 1 and are presented for the purpose of comparing the supersonic distributions from the present tests with those at subsonic Mach numbers from the previous tests.

The distribution at $M = 0.65$ in figure 4 is typical for the subsonic-type airfoil in subcritical flow. A negative pressure peak occurred at the leading edge of the upper surface, followed by a sharp pressure recovery. The high negative pressures at the peak resulted from the rapid expansion around the comparatively small leading-edge radius. Behind the negative pressure peak the local velocity increased and the pressure decreased to the 35-percent chord, the maximum thickness location, behind which a gradual pressure recovery occurred.

At $M = 0.85$ in figure 4 compressibility effects changed the distribution to that typical of transonic flow. The prominent leading-edge negative pressure peak disappeared; the pressure coefficients over the maximum thickness location were more negative on both surfaces than at $M = 0.65$; and over the forward part of the upper surface, the flow was supercritical terminated by a shock wave behind the maximum thickness location at about 50 percent chord.

The shock wave on the upper surface moved rearward to about 70 percent chord with increase in Mach number to 0.90, and the flow over the midsection of the lower surface was supersonic, probably terminated by a shock wave at about 60 percent chord.

At $M = 1.16$ the shock waves on both surfaces were still ahead of the trailing edge. Reference 2, which presents pressure distributions and schlieren photographs for a 45° sweptback wing-fuselage combination at Mach numbers up to 1.11, confirms the fact that for sweptback wings the shock wave does not reach the trailing edge until some supersonic Mach number, which undoubtedly depends upon the angle of sweep of the trailing edge.

As the Mach number increased to 2.00 the pressure coefficients on both surfaces became in general more positive, the shock wave on the upper surface moved rearward to the trailing edge, and the lower-surface shock appears to have become weaker, followed by an expansion over the trailing edge.

In general, the pressure distributions in figure 5 at $c_n \approx 0.40$ indicate the same trends with Mach number as those at $c_n \approx 0.25$.

Effect of angle of attack.-- Pressure distributions at several values of wing-section normal-force coefficient for $M \approx 1.17, 1.37, 1.56, 1.85$, and 2.00 are shown in figures 6 to 10. The effects of angle of attack upon the pressure distributions at supersonic speeds were similar at all the above Mach numbers. On the upper surface the pressures were affected by the low values of the pressure coefficient for a vacuum

$\left(P_{\text{vacuum}} = -\frac{2}{\gamma M^2} \right)$, thus limiting the extent to which the upper-surface

pressures could expand as the angle of attack increased. As a result, the pressures ahead of the shock wave reached a near vacuum state at $\alpha \approx 12^\circ$ for $M \approx 1.37$ and at $\alpha \approx 9^\circ$ for $M \approx 1.56$, and the pressure coefficients from the leading edge to the shock position were nearly constant at these angles of attack.

At all Mach numbers presented the lower-surface pressure coefficients became more positive as the angle of attack increased.

Wing-Section Aerodynamic Characteristics

The variation of section normal-force coefficient with angle of attack for $M \approx 1.17, 1.37, 1.56, 1.85$, and 2.00 is shown in figure 11. The variation was almost linear, and a general decrease in slope occurred as the Mach number increased.

Figure 12 shows the variation of the upper- and lower-surface normal-force coefficients with c_n at $M \approx 1.17, 1.37$, and 1.56 . As previously mentioned, the upper-surface pressure coefficients were noticeably limited at the higher Mach numbers by the pressure coefficient for a vacuum. Figure 12 shows that as the angle of attack increased at $M \approx 1.37$ and 1.56 normal-force coefficient for the upper surface c_{n_U} reached a maximum value above which the increase in c_n came from the increase in pressure over the lower surface. This effect can also be seen in the pressure distributions of figure 8 at $M \approx 1.56$.

It may be seen that as c_n increased from 0.6 to 0.7 the upper-surface pressures remained essentially constant, whereas the lower-surface pressures became noticeably more positive.

Figure 13 shows the variation of pitching-moment coefficient with normal-force coefficient. The curves have a stable variation with c_n , and indicate that a decrease in slope occurred at $c_n \approx 0.4$.

Figure 14 shows the variation of the center of pressure with normal-force coefficient at $M \approx 1.17, 1.37, 1.56$, and 1.85 . The curves are limited to values of c_n above 0.2 since they go to infinity at $c_n = 0$. In general, the center of pressure moved rearward with increasing c_n .

Figure 15 shows the variation of the center of pressure with Mach number at $c_n \approx 0.25$. Included in the figure are data from reference 1. At $M = 0.83$ to 0.90 the center of pressure moved rearward from about 23 percent chord to about 35 percent chord. Supersonically the center of pressure moved rearward to about 41 percent chord at $M = 2.00$.

CONCLUSIONS

Results of pressure-distribution measurements over a wing midsemi-span station of the 35° sweptback wing of the Douglas D-558-II research airplane at supersonic Mach numbers indicate that:

1. As the angle of attack increased at the higher Mach numbers, the pressure coefficient for a vacuum limited the extent to which the upper-surface pressures could expand, and consequently most of the increase in normal-force coefficient at high angles of attack can be attributed to the increase in pressure over the lower surface.
2. At high subsonic speeds the center of pressure rapidly moved rearward with increasing Mach number. At supersonic speeds the center of pressure moved rearward both with increasing Mach number and with increasing angle of attack.

High-Speed Flight Station,
National Advisory Committee for Aeronautics,
Edwards, Calif., December 27, 1954.

REFERENCES

1. Peele, James R.: Flight-Determined Pressure Measurements Over the Wing of the Douglas D-558-II Research Airplane at Mach Numbers up to 1.14. NACA RM L54A07, 1954.
2. Whitcomb, Richard T., and Kelly, Thomas C.: A Study of the Flow Over a 45° Sweptback Wing-Fuselage Combination at Transonic Mach Numbers. NACA RM L52D01, 1952.

TABLE I

PHYSICAL CHARACTERISTICS OF THE DOUGLAS D-558-II AIRPLANE

Wing:

| | |
|--|---------------------------|
| Root airfoil section (normal to 0.30 chord of unswept panel) | NACA 63-010 |
| Tip airfoil section (normal to 0.30 chord of unswept panel) | NACA 63 ₁ -012 |
| Total area, sq ft | 175.0 |
| Span, ft | 25.0 |
| Mean aerodynamic chord, in. | 87.301 |
| Root chord (parallel to plane of symmetry), in. | 108.51 |
| Extended tip chord (parallel to plane of symmetry), in. | 61.18 |
| Taper ratio | 0.565 |
| Aspect ratio | 3.570 |
| Sweep at 0.30 chord of unswept panel, deg | 35.0 |
| Sweep of leading edge, deg | 38.8 |
| Incidence at fuselage center line, deg | 3.0 |
| Dihedral, deg | -3.0 |
| Geometric twist, deg | 0 |

Horizontal tail:

| | |
|--|-------------|
| Root airfoil section (normal to 0.30 chord of unswept panel) | NACA 63-010 |
| Tip airfoil section (normal to 0.30 chord of unswept panel) | NACA 63-010 |
| Total area, sq ft | 39.9 |
| Span, in. | 143.6 |
| Mean aerodynamic chord, in. | 41.75 |
| Root chord (parallel to plane of symmetry), in. | 53.6 |
| Extended tip chord (parallel to plane of symmetry), in. | 26.8 |
| Taper ratio | 0.50 |
| Aspect ratio | 3.59 |
| Sweep at 0.30 chord line of unswept panel, deg | 40.0 |
| Dihedral, deg | 0 |

Vertical tail:

| | |
|---|-------------|
| Airfoil section (normal to 0.30 chord of unswept panel) | NACA 63-010 |
| Effective area, (area above root chord), sq ft | 36.6 |
| Height from fuselage reference line, in. | 98.0 |
| Root chord (chord 24 in. above fuselage reference line), in. | 116.8 |
| Extended tip chord (parallel to fuselage reference line), in. | 27.0 |
| Sweep angle at 0.30 chord of unswept panel, deg | 49.0 |

Fuselage:

| | |
|-------------------------------|------|
| Length, ft | 42.0 |
| Maximum diameter, in. | 60.0 |
| Fineness ratio | 8.40 |

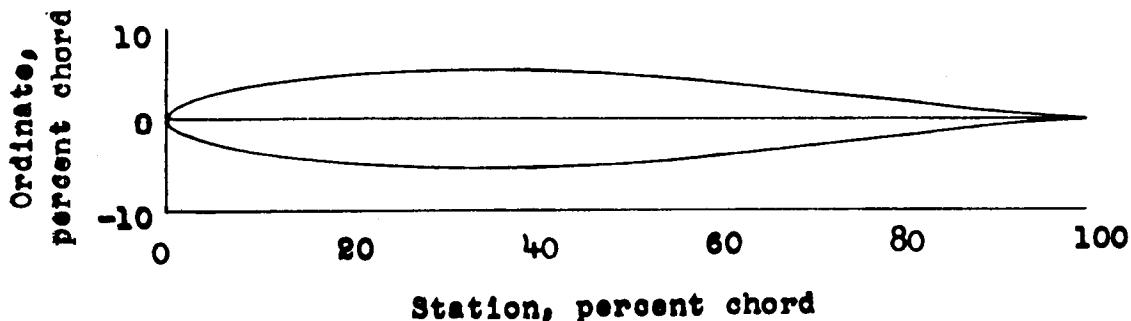
Power plant:

| | |
|------------------|----------|
| Rocket | LR8-RM-6 |
|------------------|----------|

Airplane weight, lb:

| | |
|----------------------------|--------|
| Full rocket fuel | 15,787 |
| No fuel | 9,421 |

TABLE II
 PROFILE AND ORDINATES OF THE ORIFICE STATION
 (NACA 63₍₁₀₎-0(10.86) AIRFOIL)



[Stations and ordinates given in percent of local chord]

| Station | Upper surface | Lower surface |
|--------------------|---------------|---------------|
| 0 | 0 | 0 |
| .5 | .900 | -0.900 |
| .75 | 1.090 | -1.090 |
| 1.25 | 1.385 | -1.385 |
| 2.5 | 1.907 | -1.907 |
| 5.0 | 2.650 | -2.650 |
| 7.5 | 3.204 | -3.204 |
| 10 | 3.651 | -3.651 |
| 15 | 4.337 | -4.337 |
| 20 | 4.827 | -4.827 |
| 25 | 5.162 | -5.162 |
| 30 | 5.363 | -5.363 |
| 35 | 5.430 | -5.430 |
| 40 | 5.363 | -5.363 |
| 45 | 5.176 | -5.176 |
| 50 | 4.883 | -4.883 |
| 55 | 4.496 | -4.496 |
| 60 | 4.034 | -4.034 |
| 65 | 3.512 | -3.512 |
| 70 | 2.945 | -2.945 |
| 75 | 2.352 | -2.352 |
| 80 | 1.757 | -1.757 |
| 85 | 1.182 | -1.182 |
| 90 | .656 | -0.656 |
| 95 | .232 | -0.232 |
| 100 | 0 | 0 |
| L.E. radius: 0.908 | | |

TABLE III

 PRESSURE COEFFICIENTS FOR A MIDSEMISPAN STATION ON THE WING
 OF THE D-558-II RESEARCH AIRPLANE

 $[M \approx 1.17]$

| Percent chord | Pressure coefficient | | | | | |
|--------------------|----------------------|--------------|-------------|-------------|-------------|-------------|
| | a | b | c | d | e | f |
| Upper surface | 1.2 | 0.331 | 0.276 | -0.133 | -0.202 | -0.198 |
| | 2.6 | .216 | .210 | -.124 | -.220 | -.222 |
| | 5.0 | .096 | .093 | -.061 | -.159 | -.198 |
| | 19.3 | -.025 | .023 | -.266 | -.272 | -.272 |
| | 35.0 | -.363 | -.352 | -.364 | -.376 | -.388 |
| | 51.2 | -.146 | -.141 | -.346 | -.324 | -.355 |
| | 63.8 | -.238 | -.186 | -.342 | -.337 | -.375 |
| | 70.8 | -.218 | -.212 | -.319 | -.315 | -.297 |
| | 75.5 | -.218 | -.212 | -.230 | -.272 | -.289 |
| | 80.0 | -.193 | -.187 | -.230 | -.254 | -.246 |
| | 85.1 | -.122 | -.095 | -.195 | -.211 | -.214 |
| | 94.6 | -.001 | -.001 | -.061 | -.046 | -.090 |
| Lower surface | 0 | 0.762 | 0.740 | 0.742 | 0.683 | 0.724 |
| | .7 | .336 | .457 | .620 | .642 | .655 |
| | 3.6 | .070 | .090 | .333 | .364 | .392 |
| | 5.8 | .045 | .044 | .333 | .330 | .327 |
| | 9.1 | -.122 | -.095 | .143 | .215 | .226 |
| | 18.9 | -.001 | -.001 | .108 | .093 | .126 |
| | 30.8 | -.262 | -.232 | -.021 | .001 | -.011 |
| | 34.4 | -.218 | -.212 | -.124 | -.115 | -.073 |
| | 39.7 | -.266 | -.235 | -.070 | -.055 | -.057 |
| | 43.6 | -.193 | -.187 | -.124 | -.116 | -.132 |
| | 50.6 | -.430 | -.418 | -.194 | -.159 | -.164 |
| | 56.1 | -.314 | -.212 | -.159 | -.150 | -.148 |
| | 63.7 | -.286 | -.277 | -.203 | -.244 | -.205 |
| | 70.6 | -.266 | -.212 | -.221 | -.168 | -.181 |
| | 75.1 | -.379 | -.392 | -.142 | -.168 | -.148 |
| | 84.8 | -.170 | -.141 | -.159 | -.115 | -.131 |
| | 94.5 | .070 | -.002 | .043 | .047 | .048 |
| | 98.6 | .047 | .046 | .054 | .041 | .035 |
| M | 1.110 | 1.152 | 1.182 | 1.159 | 1.167 | 1.170 |
| C _{NA} | .012 | 0 | .199 | .217 | .239 | .256 |
| α | -1.3° | -1.5° | 1.7° | 1.9° | 2.3° | 2.6° |
| c _n | -.030 | -.040 | .219 | .244 | .266 | .285 |
| c _{m c/4} | .0112 | .0144 | -.0192 | -.0218 | -.0266 | -.0256 |

TABLE III.- Continued

PRESSURE COEFFICIENTS FOR A MIDSEMISPAN STATION ON THE WING
OF THE D-558-II RESEARCH AIRPLANE

$[M \approx 1.17]$

| Percent chord | Pressure coefficient | | | | | |
|---------------|----------------------|-------------|-------------|-------------|-------------|-------------|
| | g | h | i | j | k | l |
| Upper surface | 1.2 | -0.252 | -0.275 | -0.308 | -0.354 | -0.434 |
| | 2.6 | -.278 | -.268 | -.312 | -.396 | -.409 |
| | 5.0 | -.261 | -.276 | -.312 | -.349 | -.440 |
| | 19.3 | -.334 | -.332 | -.359 | -.404 | -.432 |
| | 35.0 | -.416 | -.428 | -.438 | -.443 | -.535 |
| | 51.2 | -.408 | -.356 | -.383 | -.412 | -.417 |
| | 63.8 | -.370 | -.375 | -.378 | -.406 | -.433 |
| | 70.8 | -.326 | -.340 | -.343 | -.349 | -.369 |
| | 75.5 | -.294 | -.292 | -.312 | -.333 | -.314 |
| | 80.0 | -.260 | -.275 | -.271 | -.269 | -.296 |
| | 85.1 | -.237 | -.244 | -.225 | -.231 | -.250 |
| | 94.6 | -.066 | -.076 | -.090 | -.081 | -.117 |
| Lower surface | 0 | 0.735 | 0.675 | 0.660 | 0.654 | 0.605 |
| | .7 | .676 | .708 | .719 | .740 | .790 |
| | 3.6 | .446 | .429 | .457 | .516 | .545 |
| | 5.8 | .398 | .421 | .449 | .492 | .507 |
| | 9.1 | .242 | .244 | .274 | .312 | .325 |
| | 18.9 | .145 | .156 | .203 | .186 | .247 |
| | 30.8 | .042 | .047 | .070 | .132 | .129 |
| | 34.4 | -.050 | -.044 | -.034 | -.003 | .049 |
| | 39.7 | -.009 | -.004 | .005 | .029 | .049 |
| | 43.6 | -.132 | -.077 | -.044 | -.020 | -.008 |
| | 50.6 | -.116 | -.109 | -.067 | -.059 | -.086 |
| | 56.1 | -.131 | -.132 | -.129 | -.097 | -.053 |
| | 63.7 | -.203 | -.180 | -.177 | -.160 | -.110 |
| | 70.6 | -.139 | -.156 | -.114 | -.081 | -.030 |
| | 75.1 | -.117 | -.110 | -.076 | -.083 | -.040 |
| | 84.8 | -.131 | -.124 | -.098 | -.058 | -.045 |
| | 94.5 | .077 | .081 | .081 | .104 | .117 |
| | 98.6 | .031 | .028 | .029 | .037 | .049 |
| M | 1.173 | 1.180 | 1.183 | 1.183 | 1.176 | 1.165 |
| C_{NA} | .286 | .310 | .349 | .396 | .452 | .501 |
| α | 3.0° | 3.4° | 4.1° | 4.8° | 5.7° | 6.5° |
| c_n | .324 | .330 | .371 | .414 | .470 | .542 |
| $c_m c / 4$ | -.0307 | -.0326 | -.0390 | -.0445 | -.0477 | -.0627 |

TABLE III.- Concluded

 PRESSURE COEFFICIENTS FOR A MIDSEMISPAN STATION ON THE WING
 OF THE D-558-II RESEARCH AIRPLANE

 $[M \approx 1.17]$

| Percent chord | Pressure coefficient | | | | | |
|--------------------|----------------------|--------|--------|--------|--------|--------|
| | m | n | o | p | q | r |
| Upper surface | 1.2 | -0.535 | -0.570 | -0.593 | -0.617 | -0.654 |
| | 2.6 | -.548 | -.582 | -.598 | -.639 | -.669 |
| | 5.0 | -.548 | -.562 | -.598 | -.622 | -.628 |
| | 19.3 | -.548 | -.555 | -.614 | -.614 | -.612 |
| | 35.0 | -.628 | -.677 | -.655 | -.687 | -.685 |
| | 51.2 | -.460 | -.555 | -.502 | -.501 | -.713 |
| | 63.8 | -.468 | -.519 | -.485 | -.477 | -.505 |
| | 70.8 | -.388 | -.434 | -.445 | -.493 | -.474 |
| | 75.5 | -.364 | -.407 | -.397 | -.387 | -.425 |
| | 80.0 | -.346 | -.424 | -.370 | -.384 | -.341 |
| | 85.1 | -.324 | -.339 | -.284 | -.273 | -.270 |
| | 94.6 | -.132 | -.144 | -.131 | -.160 | -.156 |
| Lower surface | 0 | 0.542 | 0.477 | 0.521 | 0.455 | 0.451 |
| | .7 | .830 | .788 | .839 | .841 | .838 |
| | 3.6 | .603 | .727 | .634 | .626 | .664 |
| | 5.8 | .532 | .516 | .570 | .562 | .568 |
| | 9.1 | .364 | .349 | .401 | .441 | .406 |
| | 18.9 | .308 | .302 | .313 | .278 | .300 |
| | 30.8 | .164 | .172 | .199 | .197 | .202 |
| | 34.4 | .052 | .052 | .079 | .073 | .105 |
| | 39.7 | .108 | .113 | .127 | .108 | .088 |
| | 43.6 | .018 | .016 | .028 | .025 | .045 |
| | 50.6 | -.045 | -.090 | -.059 | -.040 | -.011 |
| | 56.1 | -.044 | -.015 | -.010 | .027 | .039 |
| | 63.7 | -.070 | -.065 | -.029 | -.017 | .016 |
| | 70.6 | .004 | .045 | .031 | .027 | .015 |
| | 75.1 | -.031 | -.032 | -.037 | -.025 | .003 |
| | 84.8 | .028 | .012 | .039 | .059 | .080 |
| | 94.5 | .105 | .143 | .116 | .121 | .166 |
| | 98.6 | .052 | .032 | .055 | .051 | .056 |
| M | 1.158 | 1.185 | 1.147 | 1.140 | 1.134 | 1.179 |
| C _{NA} | .548 | .574 | .601 | .621 | .648 | .833 |
| α | 7.2° | 7.6° | 8.0° | 8.4° | 8.8° | ----- |
| c _n | .580 | .624 | .629 | .639 | .697 | .914 |
| c _{m c/4} | -.0698 | -.0822 | -.0739 | -.0787 | -.0979 | -.1411 |

TABLE IV

 PRESSURE COEFFICIENTS FOR A MIDSEMISPAN STATION ON THE WING
 OF THE D-558-II RESEARCH AIRPLANE

 $[M \approx 1.37]$

| Percent chord | Pressure coefficient | | | | | | |
|--------------------|----------------------|--------|--------|--------|--------|--------|--------|
| | a | b | c | d | e | f | g |
| Upper surface | 1.2 | 0.231 | -0.216 | --- | -0.304 | -0.316 | -0.331 |
| | 2.6 | .185 | -.266 | --- | -.321 | -.318 | -.365 |
| | 5.0 | .185 | -.299 | --- | -.337 | -.318 | -.365 |
| | 19.3 | .016 | -.316 | --- | -.385 | -.397 | -.412 |
| | 35.0 | -.253 | -.448 | --- | -.496 | -.444 | -.491 |
| | 51.2 | -.152 | -.547 | --- | -.544 | -.539 | -.533 |
| | 63.8 | -.233 | -.425 | --- | -.464 | -.492 | -.475 |
| | 70.8 | -.152 | -.497 | --- | -.480 | -.444 | -.491 |
| | 75.5 | -.135 | -.349 | --- | -.417 | -.413 | -.428 |
| | 80.0 | -.135 | -.396 | --- | -.398 | -.410 | -.425 |
| | 85.1 | -.135 | -.250 | --- | -.298 | -.318 | -.286 |
| | 94.6 | -.034 | -.233 | --- | -.257 | -.239 | -.223 |
| | | | | | | | |
| Lower surface | 0 | 0.842 | 0.651 | --- | 0.558 | 0.553 | 0.547 |
| | .7 | .574 | .779 | --- | .718 | .836 | .850 |
| | 3.6 | .264 | .403 | --- | .451 | .494 | .556 |
| | 5.8 | .231 | .338 | --- | .373 | .463 | .509 |
| | 9.1 | .084 | .311 | --- | .300 | .345 | .360 |
| | 18.9 | .117 | .245 | --- | .252 | .266 | .282 |
| | 30.8 | -.035 | .058 | --- | .102 | .070 | .101 |
| | 34.4 | -.085 | -.019 | --- | -.002 | .045 | .061 |
| | 39.7 | -.119 | .031 | --- | .014 | .077 | .108 |
| | 43.6 | -.101 | -.053 | --- | -.020 | .026 | .042 |
| | 50.6 | -.251 | -.167 | --- | -.146 | -.098 | -.067 |
| | 56.1 | -.135 | -.118 | --- | -.098 | -.097 | -.081 |
| | 63.7 | -.167 | -.152 | --- | -.116 | -.115 | -.068 |
| | 70.6 | -.119 | -.134 | --- | -.098 | -.081 | -.081 |
| | 75.1 | -.216 | -.135 | --- | -.085 | -.084 | -.068 |
| | 84.8 | -.135 | -.134 | --- | -.098 | -.129 | -.049 |
| | 94.5 | -.001 | .031 | --- | .074 | .073 | .074 |
| | 98.6 | .016 | -.002 | --- | -.002 | -.002 | -.045 |
| | | | | | | | |
| M | 1.390 | 1.351 | --- | 1.371 | 1.376 | 1.377 | 1.378 |
| C _{NA} | .074 | .382 | --- | .448 | .499 | .546 | .593 |
| α | -.1° | 4.8° | --- | 5.9° | 6.7° | 7.4° | 8.2° |
| c _n | .055 | .406 | --- | .463 | .474 | .504 | .572 |
| c _{m c/4} | -.0022 | -.0554 | --- | -.0701 | -.0678 | -.0749 | -.0870 |

TABLE IV.- Concluded

PRESSURE COEFFICIENTS FOR A MIDSEMISPAN STATION ON THE WING
OF THE D-558-II RESEARCH AIRPLANE

$$[M \approx 1.37]$$

| Percent chord | Pressure coefficient | | | | | | | |
|--------------------|----------------------|--------|--------|--------|--------|--------|--------|--------|
| | h | i | j | k | l | m | n | |
| Upper surface | 1.2 | -0.390 | -0.467 | -0.516 | -0.499 | -0.517 | -0.614 | -0.602 |
| | 2.6 | -.393 | -.424 | -.488 | -.488 | -.506 | -.556 | -.575 |
| | 5.0 | -.377 | -.424 | -.535 | -.519 | -.537 | -.620 | -.575 |
| | 19.3 | -.424 | -.486 | -.551 | -.519 | -.569 | -.635 | -.591 |
| | 35.0 | -.533 | -.596 | -.614 | -.566 | -.632 | -.699 | -.657 |
| | 51.2 | -.518 | -.533 | -.661 | -.645 | -.616 | -.635 | -.657 |
| | 63.8 | -.518 | -.596 | -.629 | -.645 | -.616 | -.667 | -.673 |
| | 70.8 | -.518 | -.533 | -.661 | -.660 | -.647 | -.651 | -.608 |
| | 75.5 | -.424 | -.440 | -.535 | -.551 | -.569 | -.572 | -.542 |
| | 80.0 | -.436 | -.452 | -.547 | -.500 | -.533 | -.567 | -.553 |
| | 85.1 | -.330 | -.330 | -.457 | -.425 | -.443 | -.493 | -.428 |
| | 94.6 | -.268 | -.330 | -.410 | -.425 | -.396 | -.382 | -.378 |
| Lower surface | 0 | 0.473 | 0.421 | 0.388 | 0.420 | 0.313 | 0.226 | 0.338 |
| | .7 | .825 | .826 | .901 | .951 | .919 | .820 | 1.043 |
| | 3.6 | .597 | .581 | .614 | .661 | .695 | .699 | .854 |
| | 5.8 | .582 | .612 | .598 | .661 | .679 | .683 | .773 |
| | 9.1 | .451 | .435 | .483 | .546 | .533 | .536 | .604 |
| | 18.9 | .357 | .372 | .373 | .422 | .548 | .520 | .588 |
| | 30.8 | .207 | .283 | .283 | .345 | .347 | .348 | .443 |
| | 34.4 | .170 | .138 | .170 | .170 | .250 | .219 | .342 |
| | 39.7 | .123 | .169 | .154 | .186 | .265 | .235 | .310 |
| | 43.6 | .088 | .057 | .103 | .150 | .182 | .198 | .272 |
| | 50.6 | -.020 | .026 | -.021 | .011 | .089 | .105 | .158 |
| | 56.1 | -.018 | .044 | .013 | .014 | .076 | .093 | .178 |
| | 63.7 | -.006 | -.037 | -.008 | .024 | .070 | .101 | .139 |
| | 70.6 | -.018 | -.018 | .013 | .029 | .108 | .156 | .195 |
| | 75.1 | .009 | .024 | .038 | .085 | .116 | .255 | .203 |
| | 84.8 | -.018 | .013 | -.018 | .029 | .108 | .140 | .195 |
| | 94.5 | .150 | .165 | .196 | .212 | .261 | .245 | .320 |
| | 98.6 | .091 | .060 | .091 | .076 | .124 | .124 | .146 |
| M | 1.378 | 1.378 | 1.373 | 1.373 | 1.368 | 1.363 | 1.345 | |
| C _{NA} | .636 | .690 | .756 | .799 | .855 | .906 | .965 | |
| α | 9.1° | 10.0° | 11.2° | 11.9° | 12.8° | 13.7° | 14.7° | |
| c _n | .599 | .660 | .749 | .770 | .842 | .894 | .930 | |
| c _{m c/4} | -.0998 | -.1120 | -.1360 | -.1389 | -.1514 | -.1677 | -.1678 | |

TABLE V

PRESSURE COEFFICIENTS FOR A MIDSEMISSPAN STATION ON THE WING
OF THE D-558-II RESEARCH AIRPLANE

$[M \approx 1.56]$

| Percent chord | Pressure coefficient | | | | | |
|---------------|----------------------|--------|--------|--------|--------|--------|
| | a | b | c | d | e | f |
| Upper surface | 1.2 | 0.255 | 0.074 | 0.017 | -0.025 | -0.035 |
| | 2.6 | .236 | .043 | -.035 | -.045 | -.044 |
| | 5.0 | .129 | -.024 | -.100 | -.110 | -.119 |
| | 19.3 | .023 | -.113 | -.188 | -.154 | -.172 |
| | 35.0 | -.189 | -.258 | -.297 | -.306 | -.310 |
| | 51.2 | -.119 | -.247 | -.352 | -.306 | -.332 |
| | 63.8 | -.186 | -.314 | -.379 | -.344 | -.348 |
| | 70.8 | -.189 | -.224 | -.308 | -.262 | -.310 |
| | 75.5 | -.130 | -.280 | -.352 | -.317 | -.332 |
| | 80.0 | -.129 | -.224 | -.317 | -.293 | -.319 |
| | 85.1 | -.130 | -.224 | -.286 | -.262 | -.257 |
| | 94.6 | -.060 | -.189 | -.221 | -.176 | -.215 |
| | | | | | | |
| Lower surface | 0 | 0.889 | 0.898 | 0.951 | 0.755 | 0.789 |
| | .7 | .668 | .614 | .668 | .709 | .790 |
| | 3.6 | .372 | .448 | .503 | .544 | .586 |
| | 5.8 | .337 | .334 | .395 | .437 | .470 |
| | 9.1 | .200 | .244 | .271 | .335 | .350 |
| | 18.9 | .212 | .166 | .173 | .205 | .265 |
| | 30.8 | .045 | .104 | .079 | .144 | .141 |
| | 34.4 | -.036 | -.013 | -.046 | .020 | .041 |
| | 39.7 | -.024 | -.021 | -.046 | .064 | .073 |
| | 43.6 | -.025 | -.091 | -.069 | -.025 | -.014 |
| | 50.6 | -.153 | -.102 | -.123 | -.057 | -.035 |
| | 56.1 | -.095 | -.124 | -.166 | -.099 | -.055 |
| | 63.7 | -.117 | -.124 | -.123 | -.079 | -.046 |
| | 70.6 | -.083 | -.091 | -.155 | -.077 | -.066 |
| | 75.1 | -.151 | -.102 | -.113 | -.058 | -.036 |
| | 84.8 | -.071 | -.124 | -.166 | -.143 | -.087 |
| | 94.5 | .010 | -.014 | -.036 | .018 | .049 |
| | 98.6 | 0 | -.091 | -.111 | -.056 | -.044 |
| | | | | | | |
| M | 1.581 | 1.585 | 1.585 | 1.585 | 1.589 | 1.587 |
| C_{NA} | .107 | .200 | .251 | .301 | .351 | .390 |
| α | .6° | 2.2° | 3.0° | 3.9° | 4.7° | 5.4° |
| c_n | .109 | .222 | .274 | .305 | .357 | .375 |
| $c_m c/4$ | -.0109 | -.0310 | -.0397 | -.0422 | -.0554 | -.0608 |

TABLE V.- Concluded

PRESSURE COEFFICIENTS FOR A MIDSEMISPAN STATION ON THE WING

OF THE D-558-II RESEARCH AIRPLANE

$$[M \approx 1.56]$$

| Percent chord | Pressure coefficient | | | | | |
|-------------------|----------------------|--------|--------|--------|--------|--------|
| | g | h | i | j | k | l |
| Upper surface | 1.2 | -0.195 | -0.203 | -0.285 | -0.311 | -0.331 |
| | 2.6 | -.195 | -.204 | -.255 | -.282 | -.323 |
| | 5.0 | -.227 | -.236 | -.329 | -.354 | -.375 |
| | 19.3 | -.270 | -.289 | -.329 | -.344 | -.375 |
| | 35.0 | -.399 | -.385 | -.434 | -.427 | -.479 |
| | 51.2 | -.388 | -.385 | -.435 | -.437 | -.448 |
| | 63.8 | -.445 | -.410 | -.469 | -.481 | -.491 |
| | 70.8 | -.366 | -.364 | -.445 | -.416 | -.448 |
| | 75.5 | -.399 | -.407 | -.456 | -.458 | -.448 |
| | 80.0 | -.322 | -.340 | -.379 | -.372 | -.372 |
| | 85.1 | -.324 | -.300 | -.382 | -.365 | -.385 |
| | 94.6 | -.195 | -.183 | -.255 | -.244 | -.271 |
| Lower surface | 0 | 0.651 | 0.704 | 0.604 | 0.580 | 0.546 |
| | .7 | .751 | .827 | .810 | .853 | .866 |
| | 3.6 | .631 | .702 | .663 | .692 | .723 |
| | 5.8 | .557 | .587 | .559 | .611 | .641 |
| | 9.1 | .362 | .457 | .452 | .506 | .537 |
| | 18.9 | .319 | .404 | .357 | .402 | .381 |
| | 30.8 | .161 | .245 | .210 | .258 | .308 |
| | 34.4 | .052 | .126 | .114 | .195 | .195 |
| | 39.7 | .105 | .201 | .219 | .216 | .257 |
| | 43.6 | .017 | .070 | .069 | .099 | .109 |
| | 50.6 | -.025 | .038 | .059 | .043 | .109 |
| | 56.1 | -.002 | .041 | .030 | .029 | .081 |
| | 63.7 | -.048 | -.005 | .025 | .045 | .045 |
| | 70.6 | -.056 | -.002 | -.002 | .040 | .029 |
| | 75.1 | -.027 | .016 | .015 | .035 | .035 |
| | 84.8 | -.107 | -.055 | -.065 | -.002 | -.002 |
| | 94.5 | .033 | .113 | .121 | .140 | .139 |
| | 98.6 | -.023 | .052 | .051 | .102 | .071 |
| M | 1.563 | 1.555 | 1.549 | 1.552 | 1.544 | 1.538 |
| C _{NA} | .453 | .497 | .547 | .603 | .641 | .699 |
| α | 6.7° | 7.5° | 8.5° | 9.6° | 10.3° | 11.4° |
| c _n | .432 | .500 | .548 | .578 | .626 | .686 |
| c _m /4 | -.0624 | -.0704 | -.0893 | -.0915 | -.0982 | -.1171 |

TABLE VI

 PRESSURE COEFFICIENTS FOR A MIDSEMISPAN STATION ON THE WING
 OF THE D-558-II RESEARCH AIRPLANE

$$\left[M \approx 1.77 \right]$$

| Percent chord | Pressure coefficient | | | | | |
|--------------------|----------------------|--------|--------|--------|--------|--------|
| | a | b | c | d | e | f |
| Upper surface | 1.2 | 0.251 | 0.153 | 0.109 | 0.072 | -0.014 |
| | 2.6 | .180 | .088 | .049 | .029 | -.038 |
| | 5.0 | .142 | .054 | .026 | -.020 | -.076 |
| | 19.3 | -.023 | -.059 | -.086 | -.107 | -.183 |
| | 35.0 | -.189 | -.194 | -.198 | -.229 | -.227 |
| | 51.2 | -.136 | -.194 | -.210 | -.244 | -.270 |
| | 63.8 | -.186 | -.247 | -.229 | -.273 | -.278 |
| | 70.8 | -.197 | -.172 | -.229 | -.274 | -.302 |
| | 75.5 | -.174 | -.262 | -.198 | -.267 | -.296 |
| | 80.0 | -.188 | -.193 | -.185 | -.220 | -.293 |
| | 85.1 | -.144 | -.206 | -.175 | -.188 | -.195 |
| | 94.6 | -.106 | -.070 | -.109 | -.138 | -.164 |
| Lower surface | 0 | 0.876 | 0.845 | 0.910 | 0.876 | 0.810 |
| | .7 | .608 | .733 | .751 | .758 | .838 |
| | 3.6 | .392 | .477 | .526 | .541 | .618 |
| | 5.8 | .325 | .354 | .453 | .439 | .568 |
| | 9.1 | .210 | .269 | .327 | .329 | .476 |
| | 18.9 | .195 | .201 | .258 | .234 | .313 |
| | 30.8 | .071 | .106 | .144 | .163 | .267 |
| | 34.4 | .022 | .066 | .080 | .067 | .112 |
| | 39.7 | -.023 | -.059 | .096 | .094 | .200 |
| | 43.6 | -.024 | .030 | .055 | .028 | .116 |
| | 50.6 | -.143 | -.070 | -.025 | -.029 | .066 |
| | 56.1 | -.099 | -.047 | -.032 | -.024 | .056 |
| | 63.7 | -.098 | -.104 | -.033 | -.040 | .034 |
| | 70.6 | -.099 | -.025 | -.028 | -.094 | .056 |
| | 75.1 | -.127 | -.093 | -.052 | -.044 | .052 |
| | 84.8 | -.084 | -.047 | -.055 | -.066 | .030 |
| | 94.5 | -.032 | -.015 | .018 | .005 | .097 |
| | 98.6 | -.054 | .032 | -.005 | -.016 | .087 |
| M | 1.794 | 1.778 | 1.793 | 1.774 | 1.785 | 1.749 |
| C _{NA} | .119 | .195 | .231 | .264 | .398 | .440 |
| α | 1.5° | 2.2° | 3.6° | 4.2° | 6.1° | 7.0° |
| C _n | .123 | .202 | .246 | .274 | .397 | .438 |
| C _{mC} /4 | -.0160 | -.0291 | -.0317 | -.0397 | -.0675 | -.0707 |

TABLE VII

 PRESSURE COEFFICIENTS FOR A MIDSEMISPAN STATION ON THE WING
 OF THE D-558-II RESEARCH AIRPLANE

$$[M \approx 1.85]$$

| Percent chord | Pressure coefficient | | | | | | | | |
|--------------------|----------------------|--------|--------|--------|--------|--------|--------|--------|-------|
| | a | b | c | d | e | f | g | h | |
| Upper surface | 1.2 | 0.357 | 0.349 | 0.236 | 0.262 | 0.211 | 0.075 | 0.060 | 0.023 |
| | 2.6 | .269 | .296 | .187 | .208 | .150 | .038 | .043 | -.020 |
| | 5.0 | .286 | .238 | .142 | .143 | .114 | -.008 | -.013 | -.026 |
| | 19.3 | .024 | .040 | -.031 | -.008 | -.051 | -.127 | -.095 | -.152 |
| | 35.0 | -.077 | -.075 | -.121 | -.138 | -.152 | -.219 | -.183 | -.196 |
| | 51.2 | -.119 | -.108 | -.166 | -.131 | -.181 | -.292 | -.208 | -.246 |
| | 63.8 | -.126 | -.147 | -.171 | -.164 | -.199 | -.294 | -.242 | -.266 |
| | 70.8 | -.128 | -.133 | -.159 | -.196 | -.202 | -.272 | -.240 | -.258 |
| | 75.5 | -.144 | -.133 | -.136 | -.196 | -.217 | -.286 | -.258 | -.277 |
| | 80.0 | -.185 | -.189 | -.165 | -.194 | -.201 | -.231 | -.200 | -.238 |
| | 85.1 | -.085 | -.075 | -.114 | -.123 | -.138 | -.206 | -.152 | -.183 |
| | 94.6 | -.094 | -.091 | -.084 | -.095 | -.116 | -.193 | -.114 | -.139 |
| Lower surface | 0 | 0.904 | 0.909 | 0.832 | 0.955 | 0.937 | 0.852 | 0.847 | 0.848 |
| | .7 | .492 | .544 | .557 | .663 | .735 | .710 | .804 | .826 |
| | 3.6 | .198 | .292 | .332 | .440 | .446 | .453 | .594 | .606 |
| | 5.8 | .257 | .333 | .303 | .390 | .396 | .395 | .495 | .550 |
| | 9.1 | .168 | .222 | .240 | .288 | .337 | .328 | .420 | .445 |
| | 18.9 | .041 | .123 | .112 | .158 | .157 | .183 | .263 | .257 |
| | 30.8 | -.019 | .054 | .078 | .117 | .158 | .131 | .218 | .242 |
| | 34.4 | -.052 | -.001 | -.008 | .006 | .064 | -.002 | .112 | .112 |
| | 39.7 | -.026 | -.001 | -.001 | .042 | .085 | .031 | .163 | .150 |
| | 43.6 | -.085 | -.001 | -.032 | .012 | .019 | .029 | .085 | .085 |
| | 50.6 | -.110 | -.099 | -.113 | -.094 | -.030 | -.042 | .060 | .054 |
| | 56.1 | -.170 | -.141 | -.099 | -.095 | -.066 | -.087 | -.013 | .012 |
| | 63.7 | -.168 | -.131 | -.127 | -.094 | -.087 | -.101 | -.014 | -.009 |
| | 70.6 | -.102 | -.108 | -.099 | -.073 | -.058 | -.054 | .012 | .037 |
| | 75.1 | -.159 | -.131 | -.105 | -.101 | -.080 | -.088 | .004 | .022 |
| | 84.8 | -.119 | -.058 | -.054 | -.066 | -.066 | -.087 | -.001 | .012 |
| | 94.5 | -.069 | -.001 | -.024 | -.030 | -.009 | -.049 | .054 | .079 |
| | 98.6 | -.102 | -.058 | -.046 | -.022 | -.022 | -.034 | .050 | .043 |
| M | 1.847 | 1.850 | 1.870 | 1.864 | 1.852 | 1.836 | 1.838 | 1.821 | |
| C _{NA} | -.004 | .054 | .103 | .135 | .196 | .245 | .305 | .346 | |
| α | -1.4° | -.2° | .7° | 1.3° | 2.5° | 3.4° | 4.6° | 5.4° | |
| c _n | .007 | .054 | .099 | .130 | .182 | .252 | .302 | .337 | |
| c _{m c/4} | -.0029 | -.0106 | -.0128 | -.0154 | -.0253 | -.0381 | -.0445 | -.0547 | |

TABLE VIII

 PRESSURE COEFFICIENTS FOR A MIDSEMISPAN STATION ON THE WING
 OF THE D-558-II RESEARCH AIRPLANE
 $[M \approx 2.0]$

| Percent chord | Pressure coefficient | | | | | |
|---------------|----------------------|--------------|-------------|-------------|-------------|-------------|
| | a | b | c | d | e | f |
| Upper surface | 1.2 | 0.377 | 0.337 | 0.347 | 0.175 | 0.168 |
| | 2.6 | .271 | .245 | .251 | .103 | .096 |
| | 5.0 | .240 | .208 | .219 | .089 | .061 |
| | 19.3 | .044 | .027 | .022 | -.048 | -.083 |
| | 35.0 | -.095 | -.103 | -.107 | -.178 | -.180 |
| | 51.2 | -.099 | -.107 | -.107 | -.185 | -.194 |
| | 63.8 | -.138 | -.165 | -.151 | -.223 | -.231 |
| | 70.8 | -.126 | -.121 | -.125 | -.206 | -.228 |
| | 75.5 | -.149 | -.168 | -.157 | -.212 | -.207 |
| | 80.0 | -.143 | -.134 | -.143 | -.184 | -.213 |
| | 85.1 | -.117 | -.149 | -.135 | -.199 | -.200 |
| | 94.6 | -.068 | -.061 | -.066 | -.103 | -.131 |
| | | | | | | -.124 |
| Lower surface | 0 | 0.908 | 0.912 | 0.934 | 0.912 | 0.901 |
| | .7 | .509 | .534 | .533 | .757 | .799 |
| | 3.6 | .280 | .305 | .311 | .492 | .488 |
| | 5.8 | .240 | .246 | .270 | .384 | .420 |
| | 9.1 | .168 | .171 | .178 | .294 | .323 |
| | 18.9 | .079 | .097 | .104 | .212 | .206 |
| | 30.8 | .010 | .020 | .037 | .131 | .165 |
| | 34.4 | -.046 | -.028 | -.024 | .075 | .055 |
| | 39.7 | -.024 | -.024 | -.006 | .027 | .020 |
| | 43.6 | -.081 | -.084 | -.061 | .019 | .046 |
| | 50.6 | -.099 | -.107 | -.093 | -.001 | .012 |
| | 56.1 | -.104 | -.117 | -.098 | -.007 | .055 |
| | 63.7 | -.120 | -.116 | -.110 | -.062 | -.043 |
| | 70.6 | -.105 | -.112 | -.112 | 0 | -.007 |
| | 75.1 | -.155 | -.147 | -.142 | -.069 | -.057 |
| | 84.8 | -.122 | -.117 | -.130 | -.027 | -.028 |
| | 94.5 | -.064 | -.043 | -.047 | -.008 | .005 |
| | 98.6 | -.091 | -.103 | -.084 | -.007 | -.001 |
| | | | | | | -.006 |
| M | 1.955 | 1.958 | 1.954 | 2.001 | 2.001 | 1.999 |
| C_{NA} | .006 | .021 | .033 | .183 | .210 | .230 |
| α | -1.4° | -1.1° | $-.8^\circ$ | 2.6° | 3.2° | 3.6° |
| c_n | .022 | .039 | .050 | .210 | .238 | .246 |
| $c_m c/4$ | -.0045 | -.0045 | -.0054 | -.0336 | -.0390 | -.0397 |

TABLE IX

 PRESSURE COEFFICIENTS FOR A MIDSEMISPAN STATION ON THE WING
 OF THE D-558-II RESEARCH AIRPLANE

$$[c_n \approx 0.09]$$

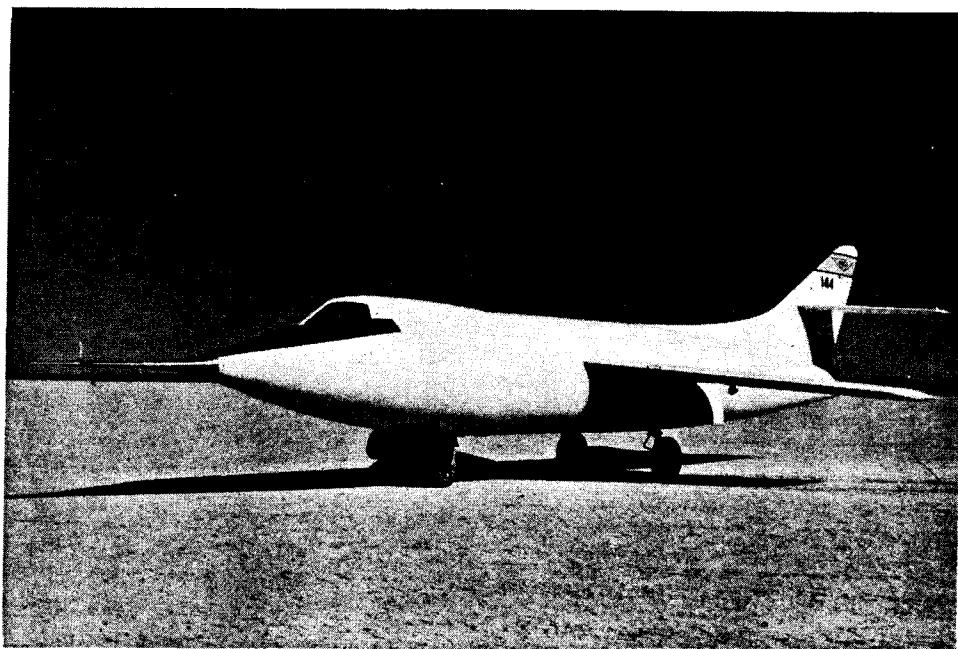
| Percent chord | Pressure coefficient | | | | | |
|---------------|----------------------|--------|--------|--------|--------|--------|
| | a | b | c | d | e | f |
| Upper surface | 1.2 | 0.241 | 0.244 | 0.231 | 0.310 | 0.231 |
| | 2.6 | .200 | .186 | .176 | .315 | .185 |
| | 5.0 | .044 | .095 | .137 | .141 | .185 |
| | 19.3 | .021 | -.042 | -.020 | .042 | .016 |
| | 35.0 | -.336 | -.312 | -.296 | -.280 | -.253 |
| | 51.2 | -.180 | -.188 | -.178 | -.206 | -.152 |
| | 63.8 | -.242 | -.266 | -.252 | -.227 | -.233 |
| | 70.8 | -.202 | -.188 | -.178 | -.206 | -.152 |
| | 75.5 | -.180 | -.167 | -.158 | -.206 | -.135 |
| | 80.0 | -.179 | -.166 | -.157 | -.102 | -.135 |
| | 85.1 | -.157 | -.167 | -.158 | -.156 | -.135 |
| | 94.6 | -.023 | -.022 | -.040 | -.057 | -.034 |
| | | | | | | -.071 |
| Lower surface | 0 | 0.707 | 0.728 | 0.960 | 0.745 | 0.842 |
| | .7 | .487 | .521 | .560 | .474 | .574 |
| | 3.6 | .218 | .224 | .270 | .236 | .264 |
| | 5.8 | .152 | .162 | .212 | .163 | .231 |
| | 9.1 | -.023 | .081 | .058 | .017 | .084 |
| | 18.9 | .044 | .082 | .078 | -.008 | .117 |
| | 30.8 | -.134 | -.084 | -.076 | -.082 | -.035 |
| | 34.4 | -.235 | -.146 | -.138 | -.206 | -.085 |
| | 39.7 | -.235 | -.167 | -.158 | -.156 | -.119 |
| | 43.6 | -.179 | -.145 | -.138 | -.157 | -.101 |
| | 50.6 | -.377 | -.330 | -.293 | -.204 | -.251 |
| | 56.1 | -.180 | -.167 | -.158 | -.057 | -.135 |
| | 63.7 | -.221 | -.205 | -.194 | -.082 | -.167 |
| | 70.6 | -.157 | -.146 | -.138 | -.107 | -.119 |
| | 75.1 | -.374 | -.246 | -.252 | -.227 | -.216 |
| | 84.8 | -.113 | -.084 | -.119 | -.156 | -.135 |
| | 94.5 | .020 | .039 | .017 | .016 | -.001 |
| | 98.6 | .044 | .041 | .039 | .067 | .016 |
| | M | 1.201 | 1.256 | 1.293 | 1.293 | 1.390 |
| | C_{NA} | .062 | .078 | .083 | .061 | .074 |
| | α | -.6° | -.3° | -.2° | -.5° | 0° |
| | c_n | .032 | .066 | .055 | .045 | .055 |
| | $c_{mc}/4$ | -.0019 | -.0070 | -.0038 | -.0163 | -.0022 |
| | | | | | | -.0109 |

TABLE IX.- Concluded

PRESSURE COEFFICIENTS FOR A MIDSEMISPAN STATION ON THE WING
OF THE D-558-II RESEARCH AIRPLANE

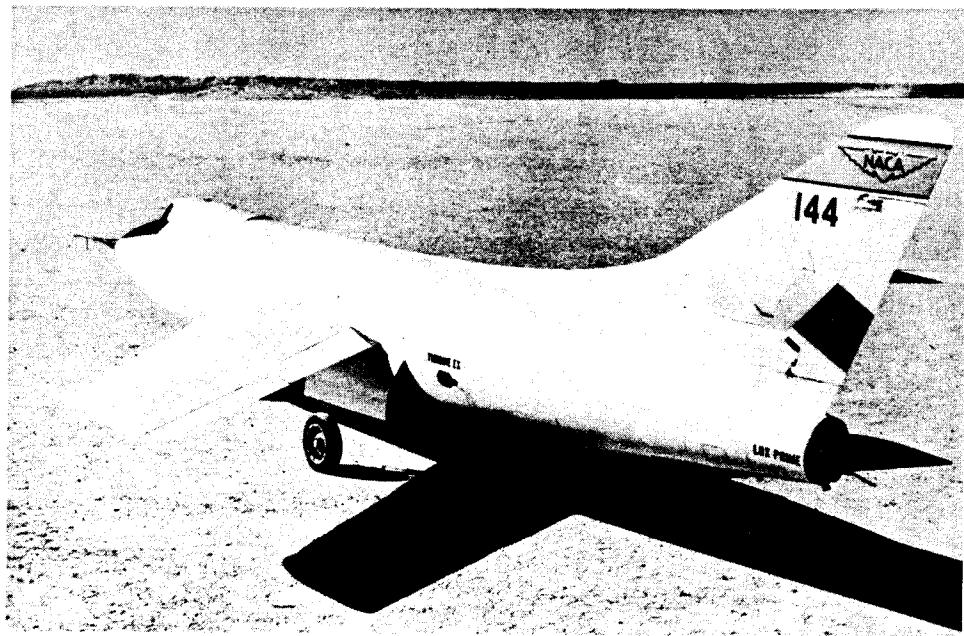
$$[c_n \approx 0.09]$$

| Percent chord | Pressure coefficient | | | | |
|---------------|----------------------|--------|--------|--------|--------|
| | g | h | i | j | k |
| Upper surface | 1.2 | 0.255 | 0.251 | 0.251 | 0.236 |
| | 2.6 | .236 | .164 | .180 | .187 |
| | 5.0 | .129 | .136 | .142 | .142 |
| | 19.3 | .023 | -.029 | -.023 | -.031 |
| | 35.0 | -.189 | -.203 | -.189 | -.121 |
| | 51.2 | -.119 | -.138 | -.136 | -.166 |
| | 63.8 | -.186 | -.181 | -.186 | -.171 |
| | 70.8 | -.189 | -.193 | -.197 | -.159 |
| | 75.5 | -.130 | -.148 | -.174 | -.136 |
| | 80.0 | -.129 | -.210 | -.188 | -.165 |
| | 85.1 | -.130 | -.138 | -.144 | -.114 |
| | 94.6 | -.060 | -.093 | -.106 | -.084 |
| Lower surface | 0 | 0.889 | 0.894 | 0.876 | 0.832 |
| | .7 | .668 | .603 | .608 | .557 |
| | 3.6 | .372 | .378 | .392 | .332 |
| | 5.8 | .337 | .351 | .325 | .303 |
| | 9.1 | .200 | .246 | .210 | .240 |
| | 18.9 | .212 | .155 | .195 | .112 |
| | 30.8 | .045 | .086 | .071 | .078 |
| | 34.4 | -.036 | -.047 | .022 | -.008 |
| | 39.7 | -.024 | -.010 | -.023 | -.001 |
| | 43.6 | -.025 | -.020 | -.024 | -.032 |
| | 50.6 | -.153 | -.119 | -.143 | -.113 |
| | 56.1 | -.095 | -.074 | -.099 | -.099 |
| | 63.7 | -.117 | -.101 | -.098 | -.127 |
| | 70.6 | -.083 | -.111 | -.099 | -.099 |
| | 75.1 | -.151 | -.137 | -.127 | -.105 |
| | 84.8 | -.071 | -.102 | -.084 | -.054 |
| | 94.5 | .010 | -.011 | -.032 | -.024 |
| | 98.6 | 0 | -.029 | -.054 | -.046 |
| M | 1.581 | 1.708 | 1.794 | 1.870 | 1.889 |
| c_{NA} | .107 | .107 | .119 | .103 | .094 |
| α | .6° | .7° | 1.0° | .7° | .5° |
| c_n | .109 | .123 | .123 | .099 | .097 |
| $c_{m_c}/4$ | -.0109 | -.0131 | -.0160 | -.0128 | -.0112 |



(a) Three-quarter front view.

L-87501



(b) Three-quarter rear view.

L-87502

Figure 1.- Photographs of the Douglas D-558-II research airplane.

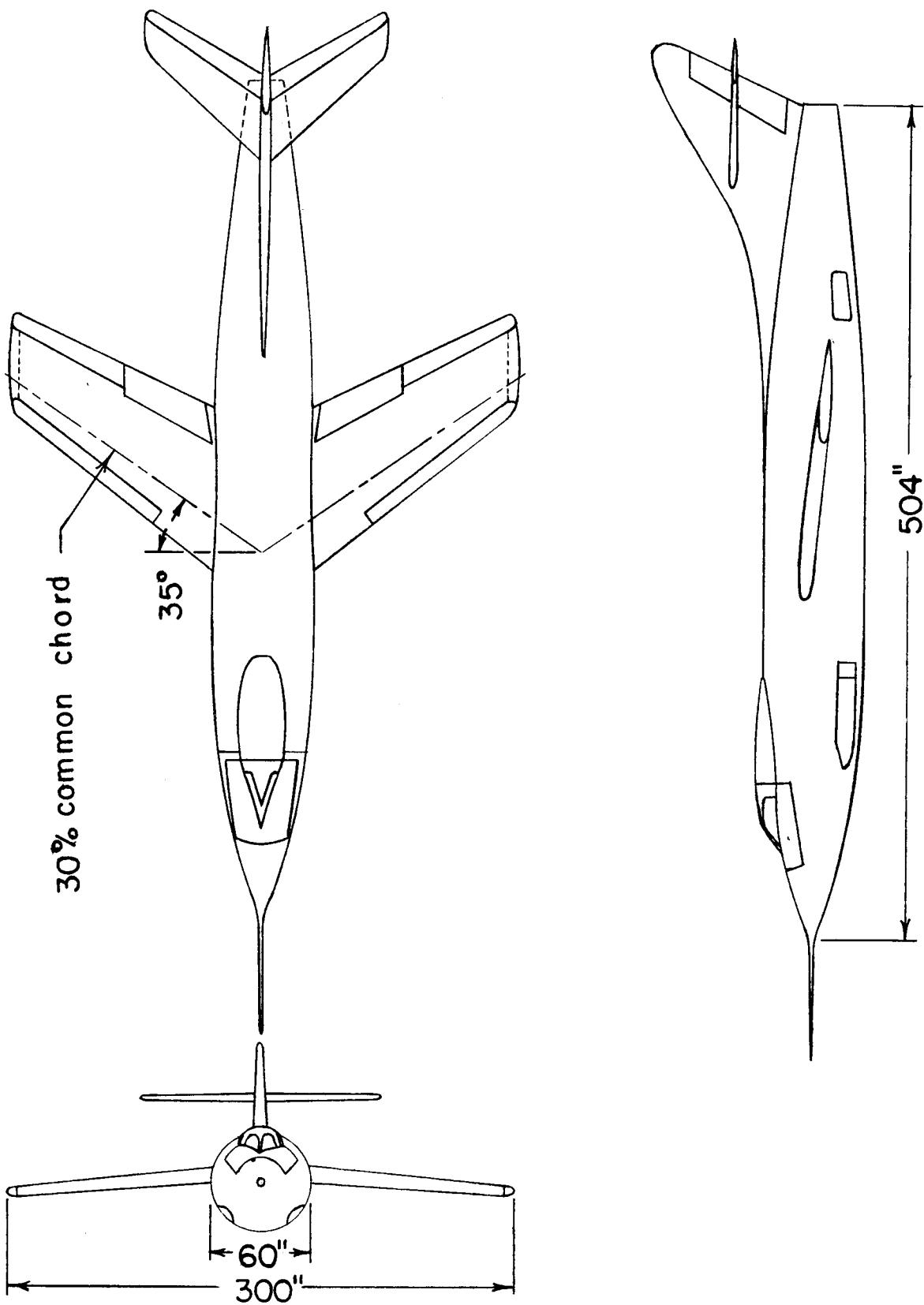


Figure 2.- Three-view drawing of the Douglas D-558-II research airplane.

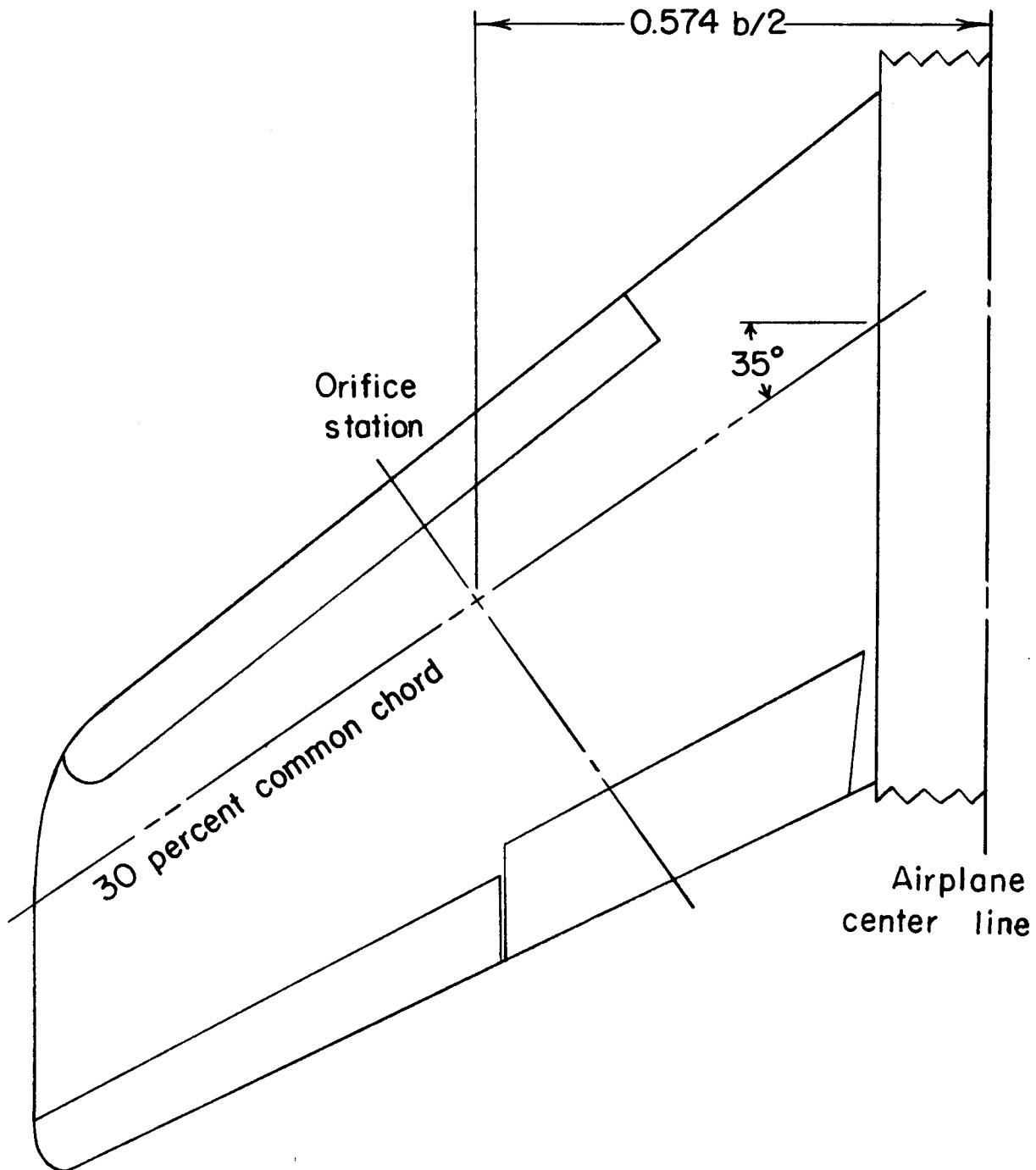


Figure 3.- Location of static-pressure orifices.

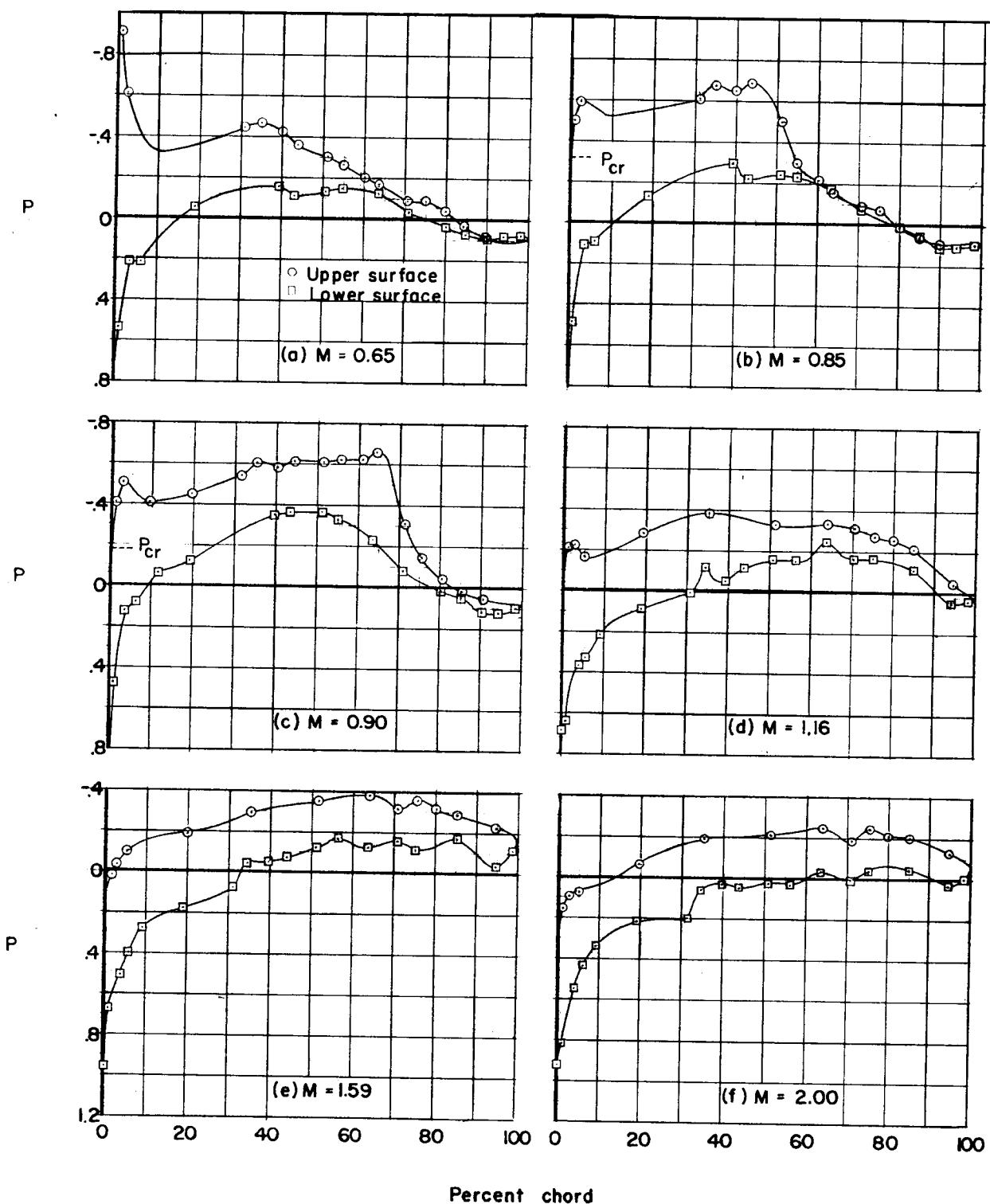


Figure 4.- Pressure distribution over a midsemispan wing station of the D-558-II research airplane at several Mach numbers. $c_n = 0.25 \pm 0.04$.

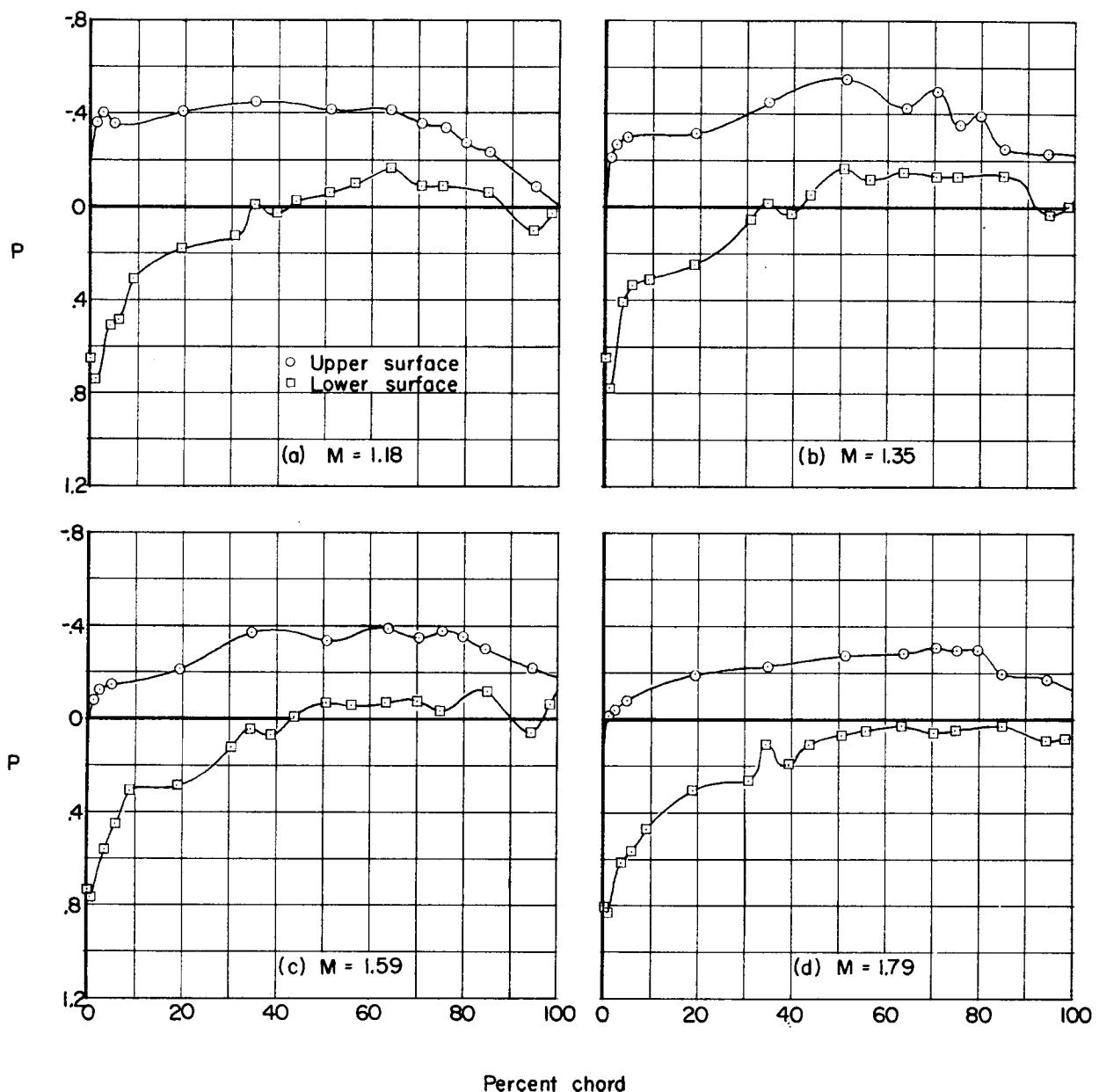


Figure 5.- Pressure distribution over a midsemispan wing station of the D-558-II research airplane at several Mach numbers. $c_n = 0.40 \pm 0.02$.

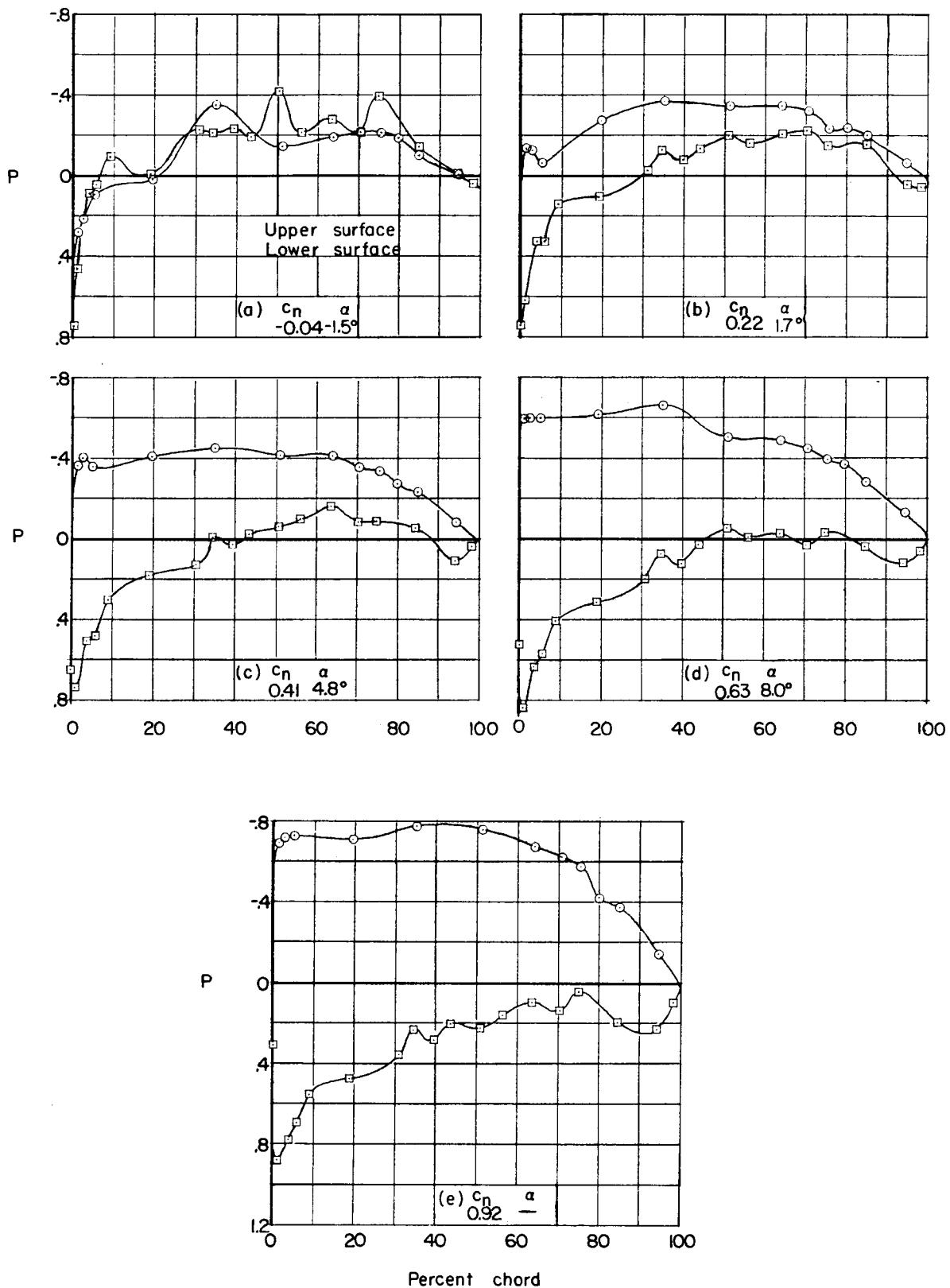


Figure 6.- Pressure distribution over a midsemispan wing station of the D-558-II research airplane at several values of wing section normal-force coefficient. $M = 1.17 \pm 0.03$.

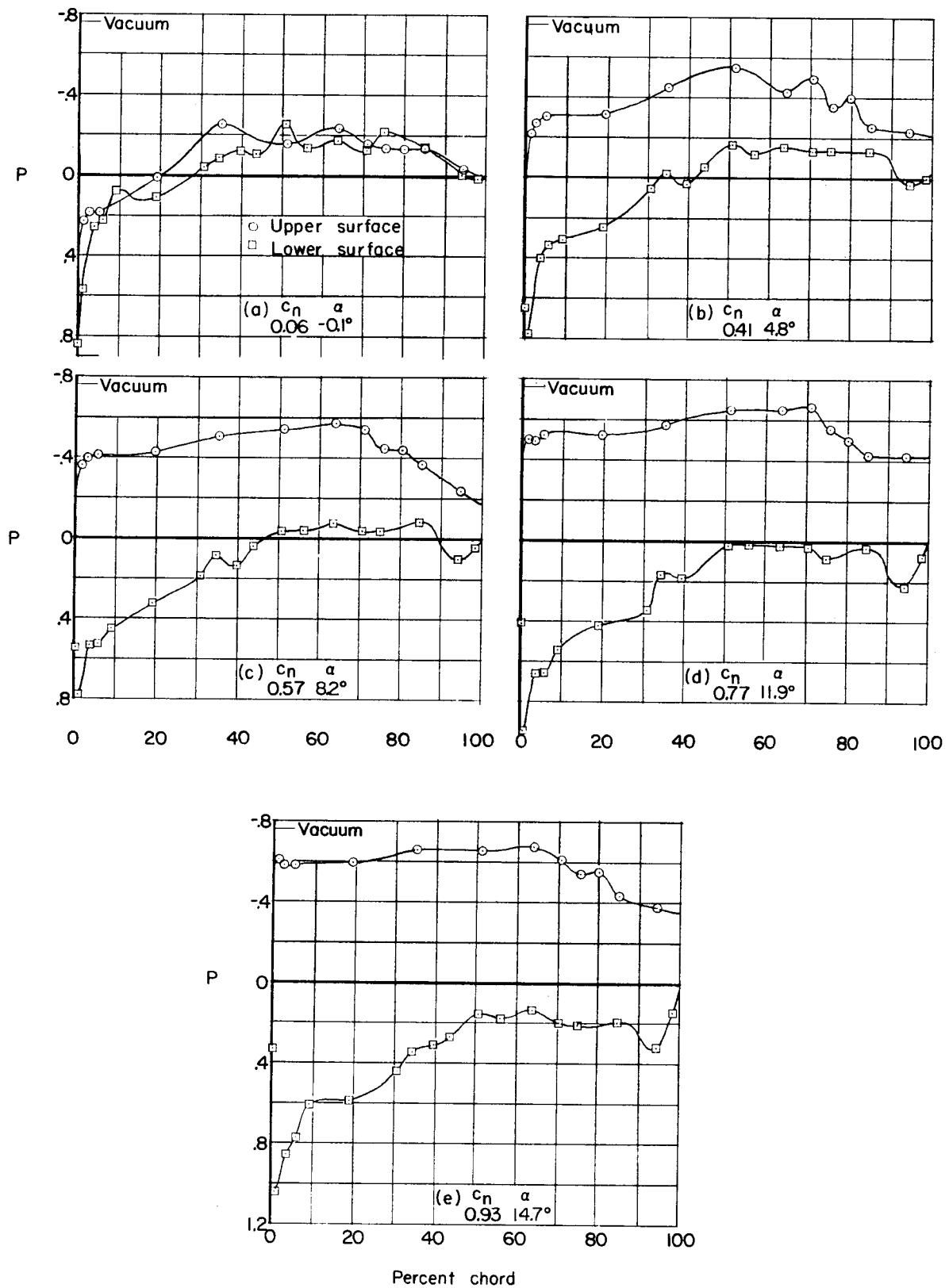


Figure 7.- Pressure distribution over a midsemispan wing station of the D-558-II research airplane at several values of wing section normal-force coefficient. $M = 1.37 \pm 0.03$.

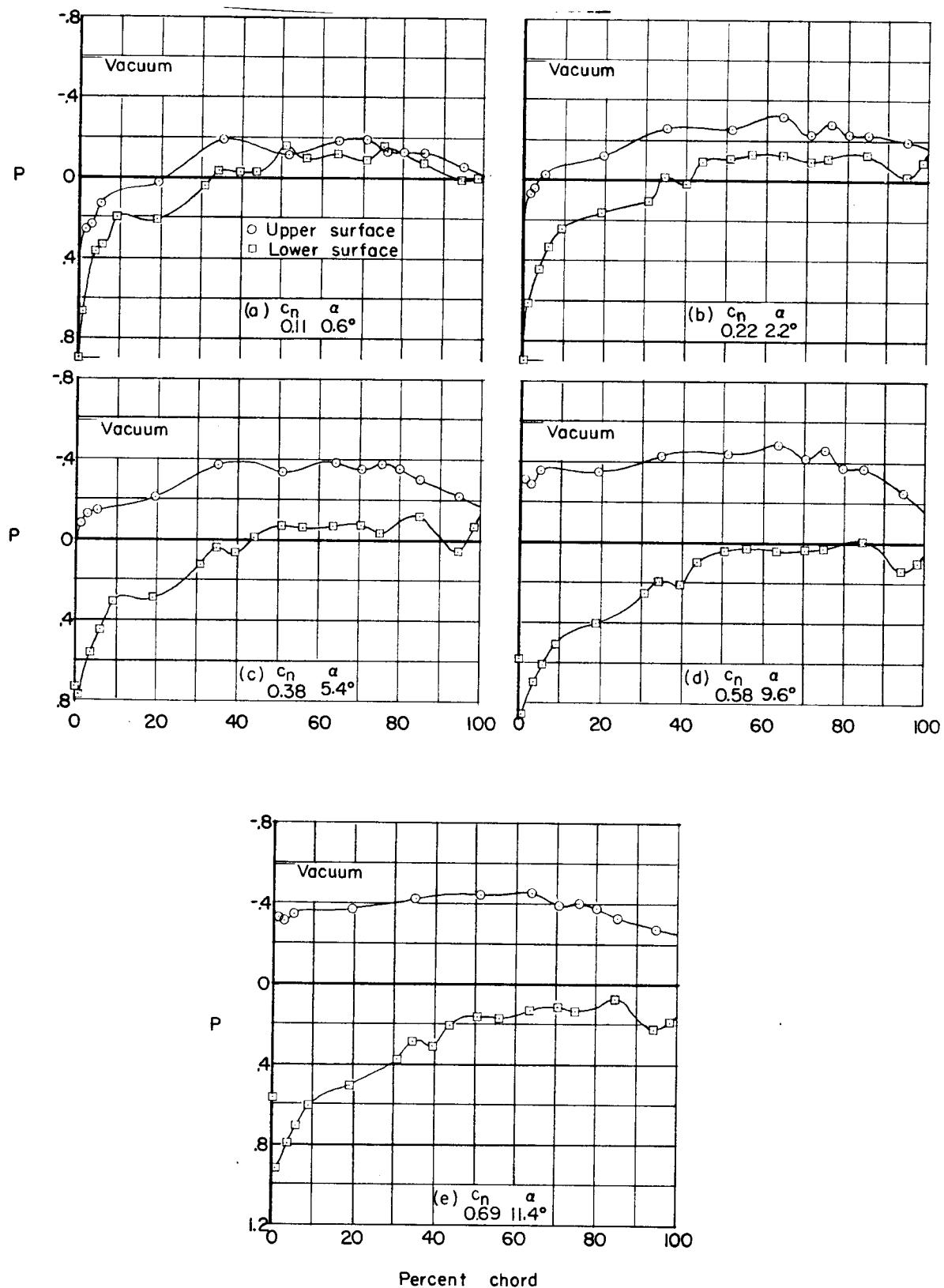


Figure 8.- Pressure distribution over a midsemispan wing station of the D-558-II research airplane at several values of wing section normal-force coefficient. $M = 1.56 \pm 0.03$.

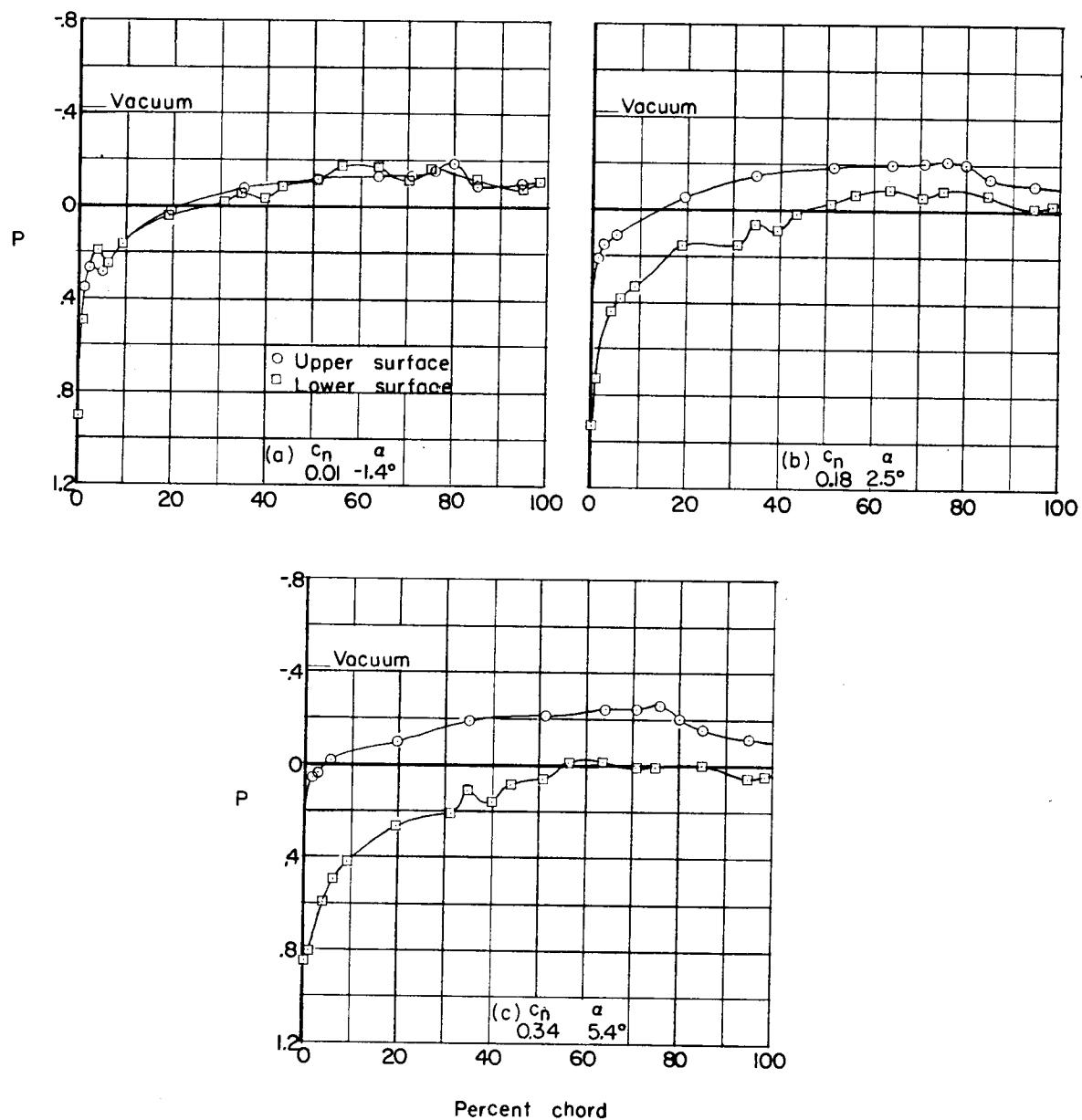


Figure 9.- Pressure distribution over a midsemispan wing station of the D-558-II research airplane at several values of wing section normal-force coefficient. $M = 1.85 \pm 0.03$.

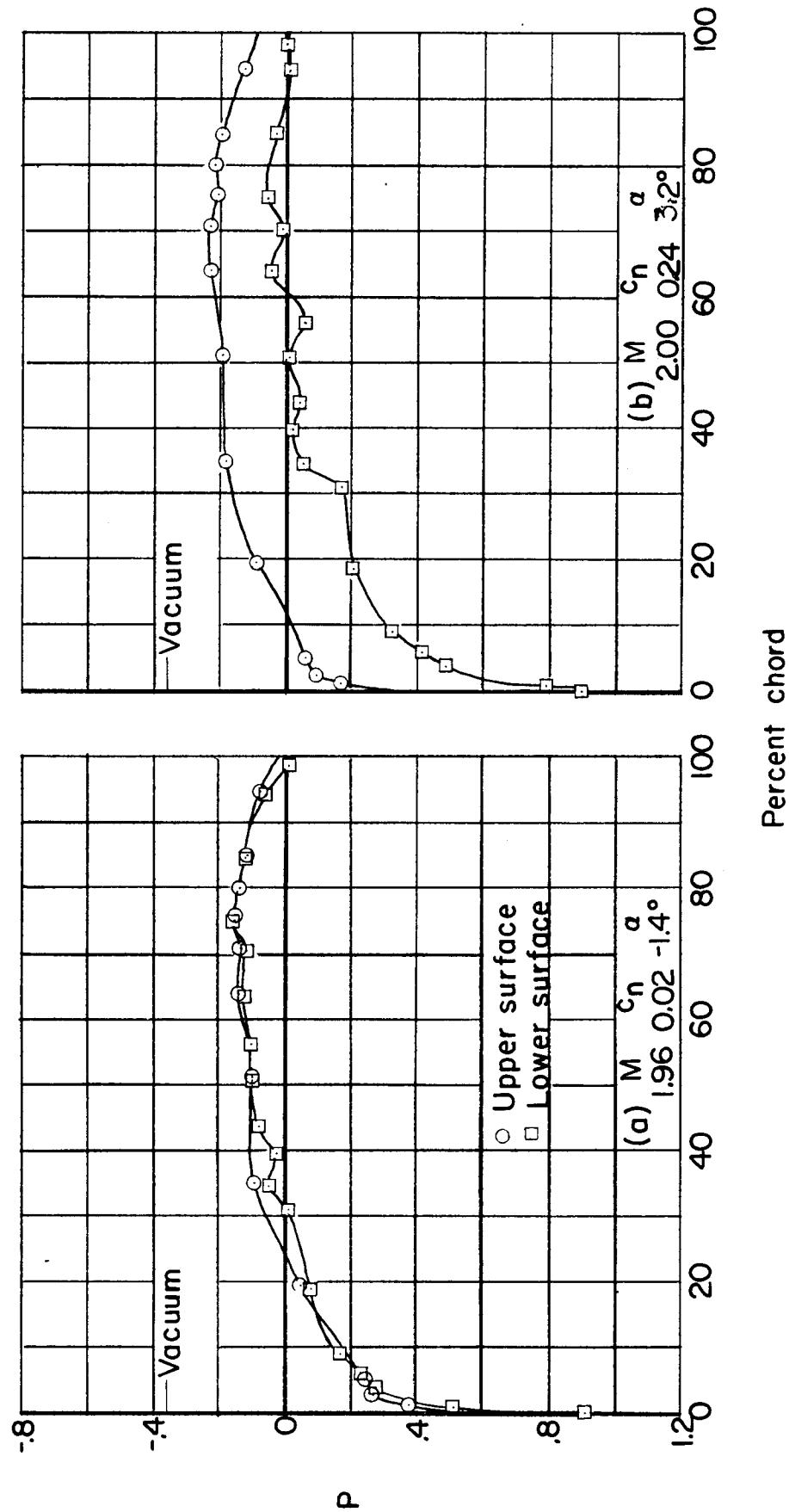


Figure 10.- Pressure distribution over a midsemispan wing station of the D-558-II research airplane. $M \approx 2.0$.

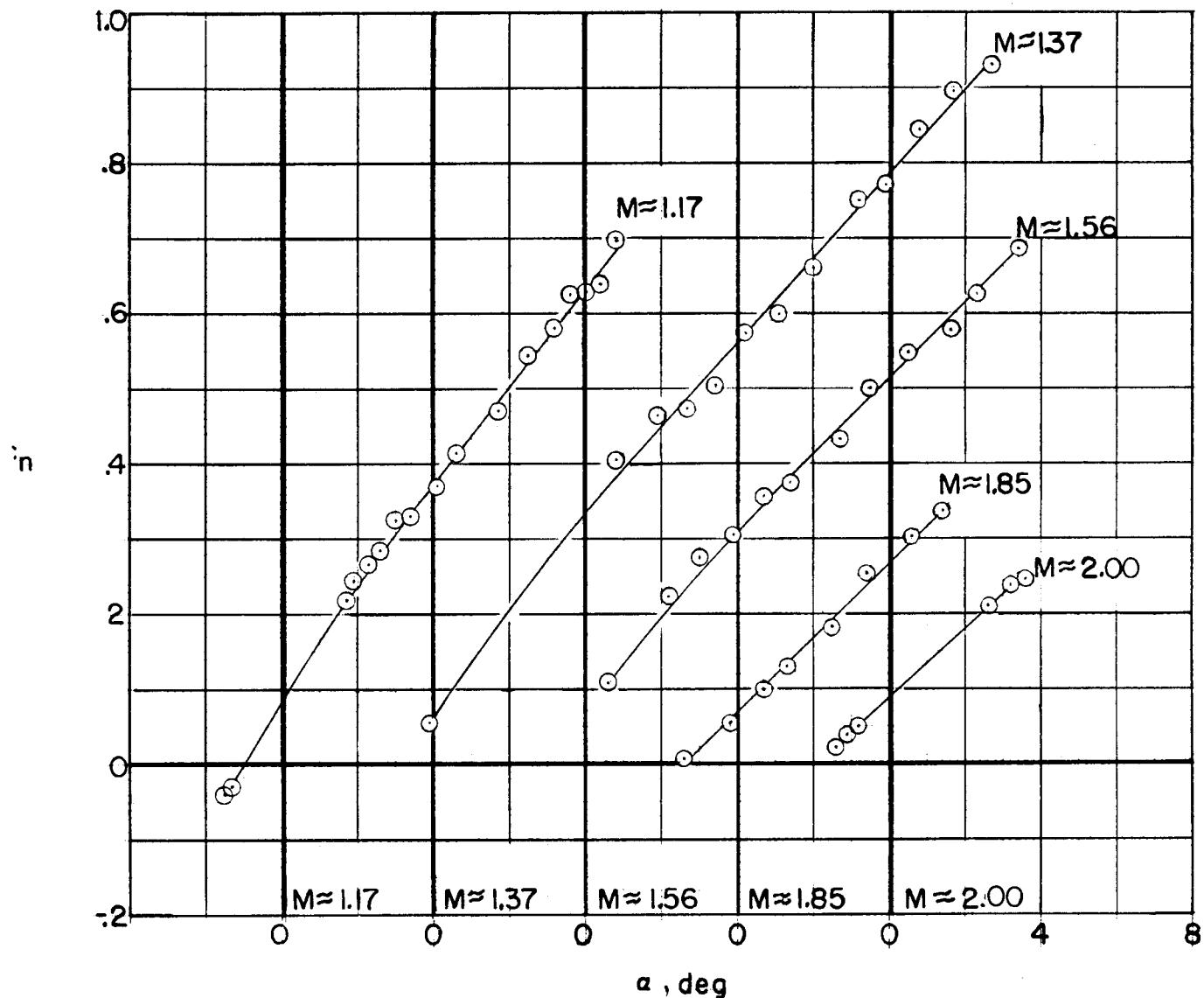


Figure 11.- Variation of wing section normal-force coefficient with air-plane angle of attack at several Mach numbers.

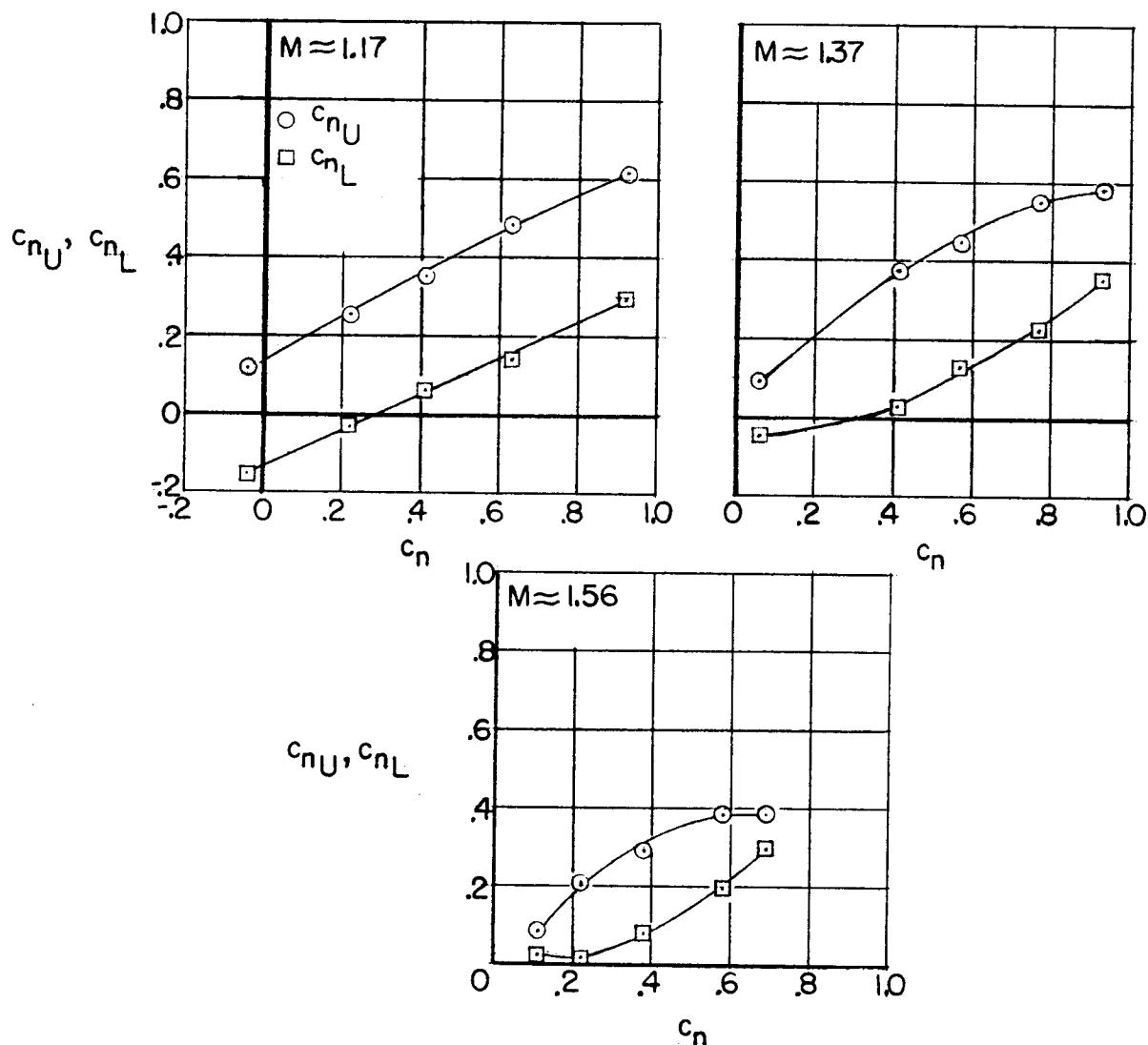


Figure 12.- Variation of upper- and lower-surface normal-force coefficients with total wing section normal-force coefficient at several Mach numbers.

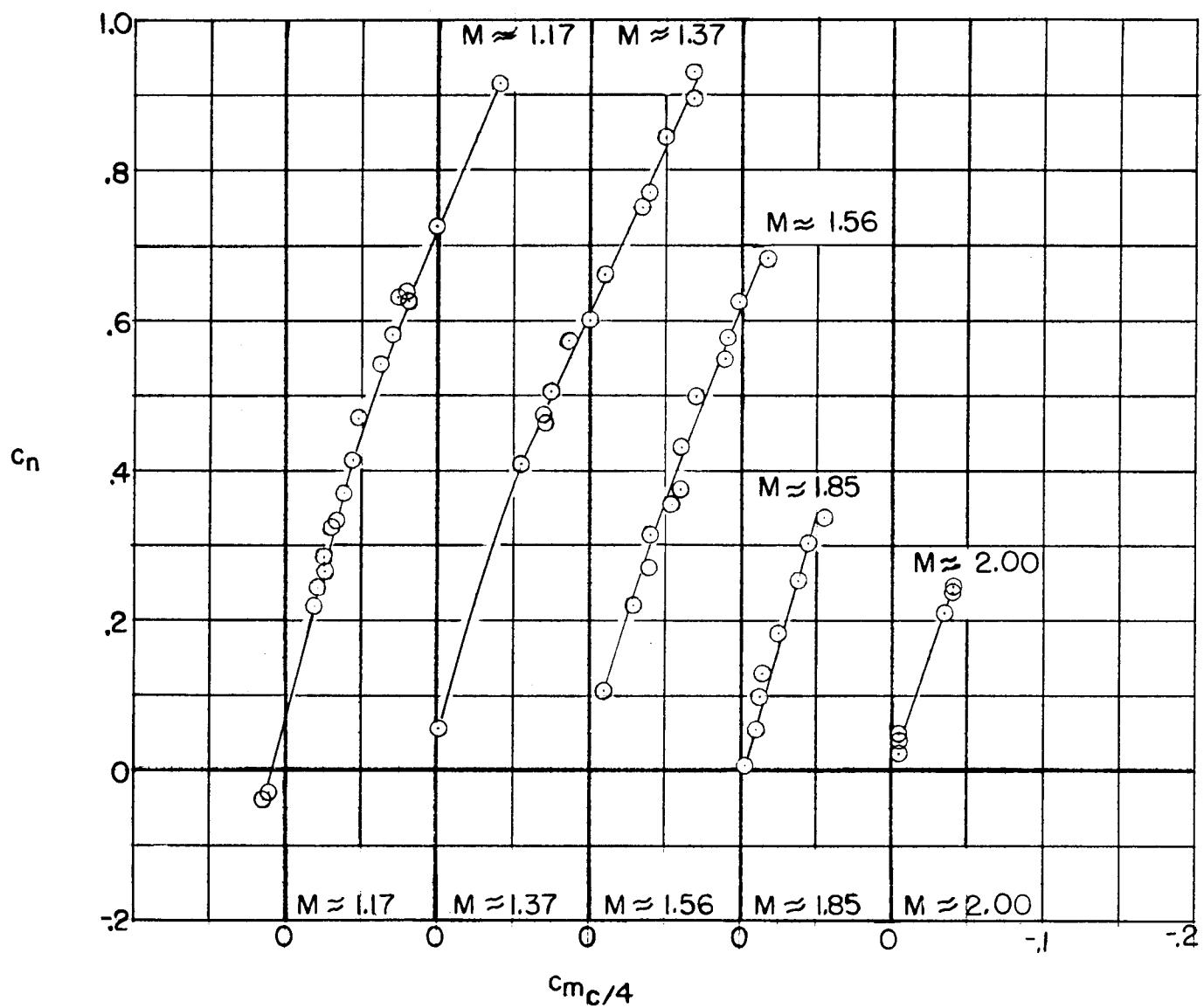


Figure 13.- Variation of wing section pitching-moment coefficient with wing section normal-force coefficient at several Mach numbers.

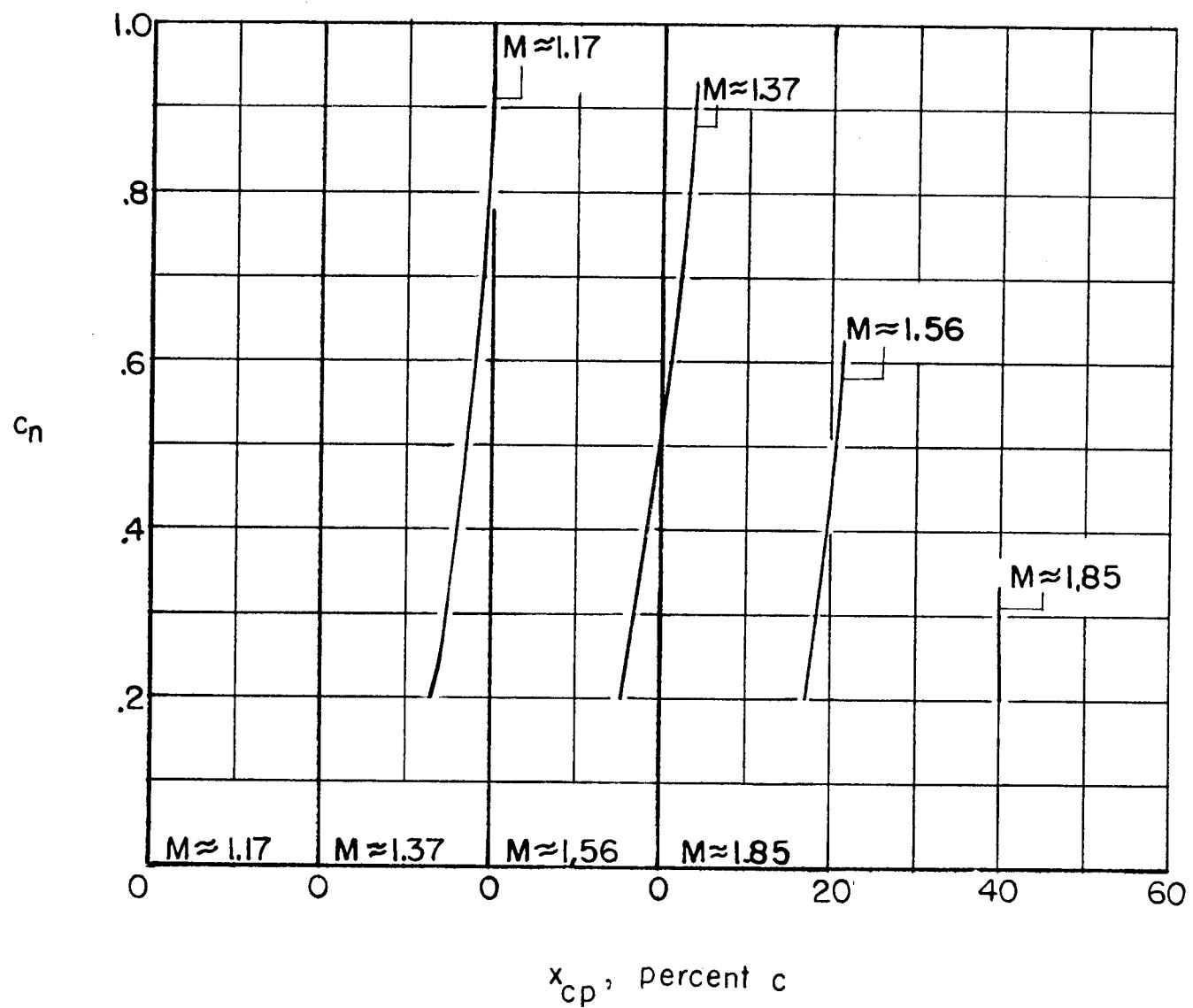


Figure 14.- Variation of wing section center of pressure with wing section normal-force coefficient at several Mach numbers.

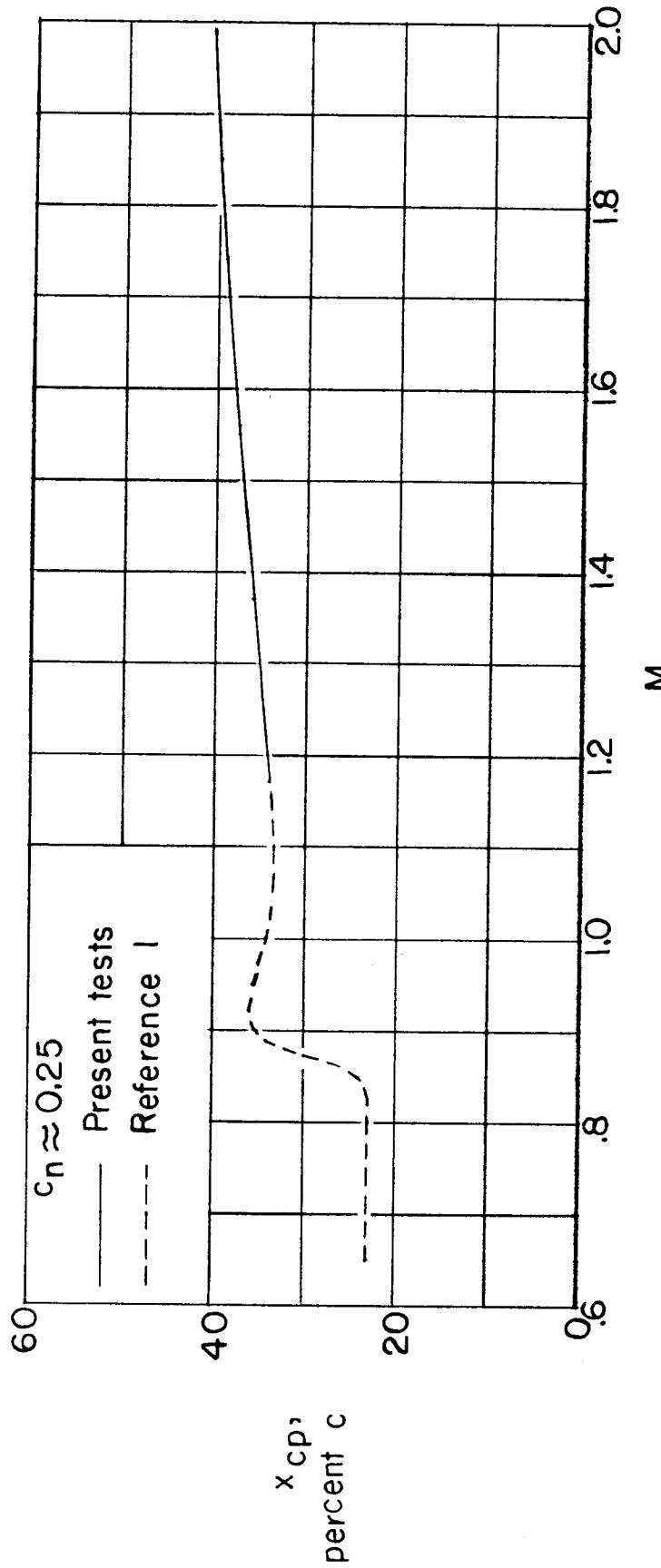


Figure 15.- Variation of center of pressure of the wing section with Mach number.